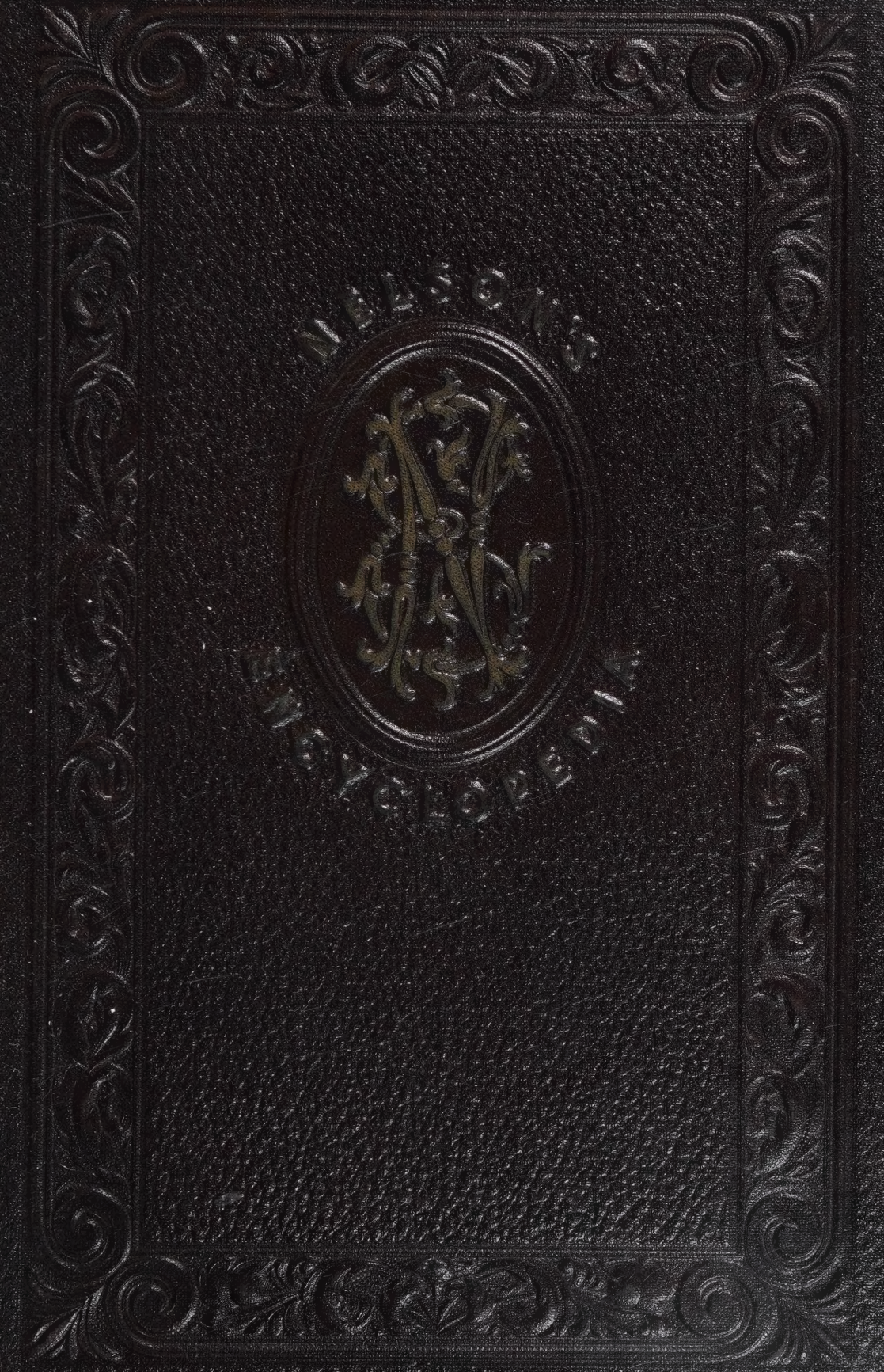
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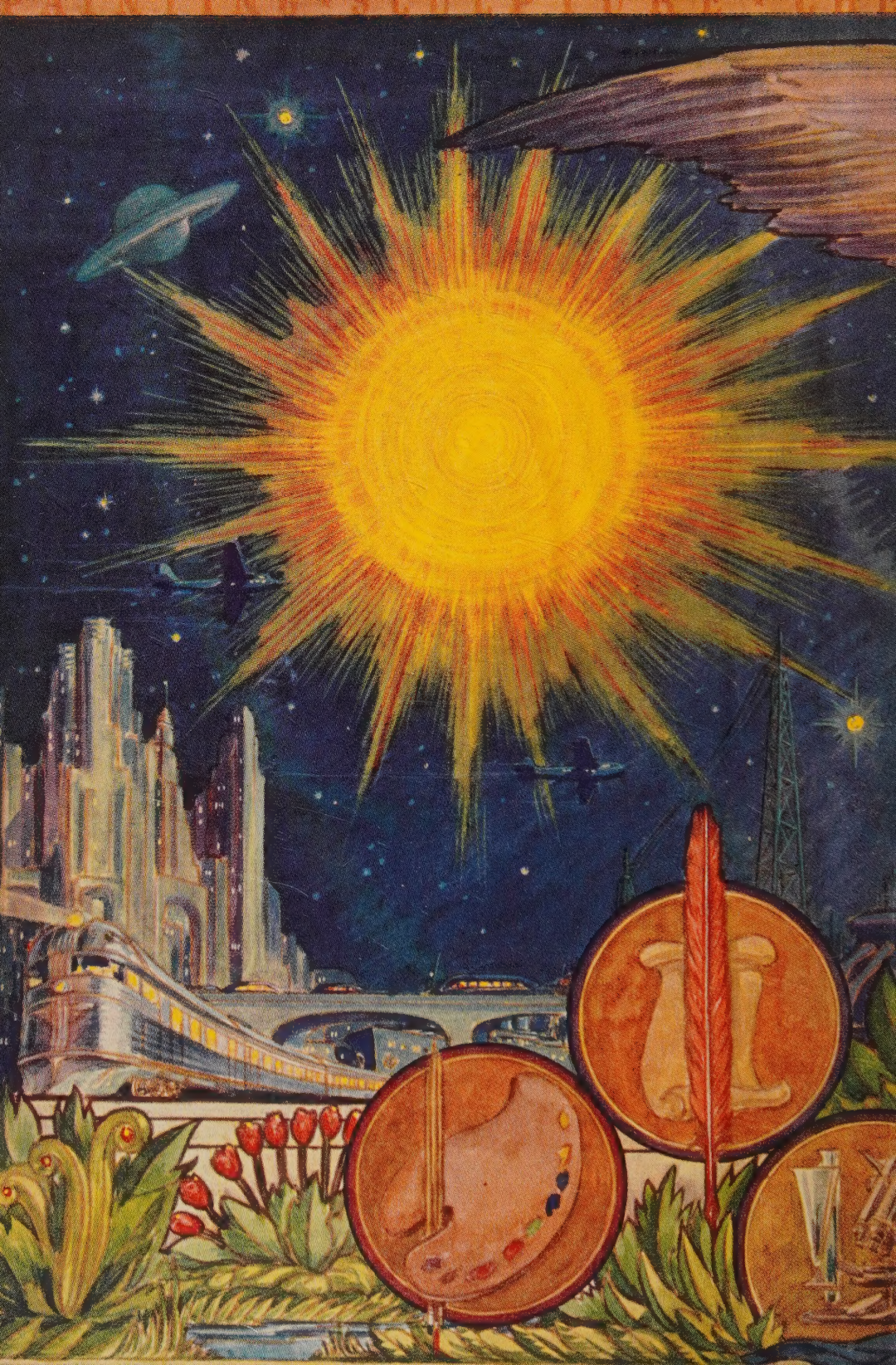

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great influence. Another prominent propagandist is Dr. C. W. Saleeby, who is the author of *Parenthood and Race Culture* (1909), besides numerous other contributions on the subject of eugenics. To-day, also, from institutions caring for delinquents and defectives, from charitable socities, is coming a great body of important evidence, and the interest grows apace.

In 1911 the New York State Board of Charities established a Bureau of Analysis and Investigation, to make special studies of the hereditary factors in its problems. Most significant of recent developments, perhaps, is the laboratory established in connection with the New York State Reformatory for Women at Bedford, New York.

On the Continent, societies have lately been started in Germany—notably the Internationale Gesellschaft für Rassenhygiene, which publishes the *Archiv für Rassen und Gesellschafts Biologie*—and in France. A scheme for a similar society is being developed in Hungary

The first International Eugenics Conference was held at London in August, 1912, and was attended by people from many lands. In addition to the works already mentioned, consult Karl Pearson's *Groundwork of Eugenics* (1909), *Practical Problems of Eugenics* (1909), and *State of National Eugenics* (1909); W. C. D. Whetham's *Eugenics and Unemployment* (1910) and *The Family and the Nation* (1909); Sir Francis Galton's *Natural Inheritance* (1889) and *Essays in Eugenics* (1909); Darbyshire's *Breeding and the Mendelian Discovery* (1910); Marshall's *The Physiology of Reproduction* (1910).

Eugenius, the name of four Popes:—

(**1.**) EUGENIUS I., SAINT (654-57), was chosen to succeed Martin I. He attempted, without success, to reconcile the Eastern and Western churches, divided over the Monothelete controversy.

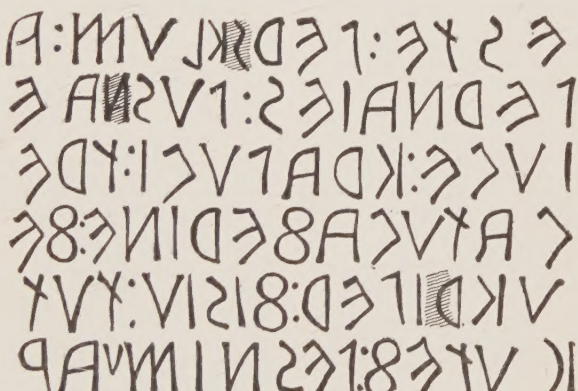
(**2.**) EUGENIUS II. (824–27) signed a political concordat with the Emperor, Louis the Pious (824); but he called a council at Rome (826) without imperial representation, which issued decrees for the reform of the clergy.

(**3.**) EUGENIUS III. (1145–53) was a disciple of St. Bernard of Clairvaux, whose letters to him are of great interest. Most of his pontificate was spent outside of Rome, where the revolutionary party, under Arnold of Brescia (q. v.), was in control. He made the appeal for the second crusade.

(**4.**) EUGENIUS IV. (1431–47) carried on with the Council of Bâle (q. v.) a struggle that ended in a papal triumph with the summoning of the council to Ferrara (1438) to consider Union with the Greek Church. The defeat of the Council of Bâle and the Decree of Union (1439) greatly enhanced the European prestige of the papacy. Consult Creighton's *History of the Papacy* (1903).

Eugenol ($C_6H_3(OH)OCH_3.C_3H_5$), the chief constituent of oil of cloves, and occurring also in calamus oil, oil of nutmeg, and oils from cinnamon, sassafras, and bay leaves. Pure eugenol is colorless, but darkens on exposure to the air. The boiling point is 253.5° C. On oxidation with potassium permanganate it yields homo-vanillin, vanillic acid, and vanillin, the odorous principle of vanilla.

Eugubine, or IGUVINE TABLES, seven tablets of brass engraved



Portion of Text of First Eugubine Tablet.

with inscriptions in ancient Umbrian, discovered in 1444 in a ruined theatre near Gubbio in Central Italy, and now preserved there. They are of the highest possible importance for the study of the early languages of Italy. There are 447 lines, read from right to left, partly in Roman, mainly in Etruscan characters; but the language is Umbrian throughout. For three hundred years their meaning remained unknown. The first attempts at interpretation were made early in the seventeenth century. O. Müller first proved the language not to be Etruscan; and Aufrecht and Kirchhoff finally solved the problem. The tables contain the acts of a corporation of priests, twelve in number, called the Attidian Brethren. Consult F. W. Newman's *Text of the Iguvine Inscriptions;* Conway's *Italic Dialects.*

Euhemerus and **Euhemerism.** Euhemerus of Messene was a Sicilian Greek. About 316 B.C. he was at the court of Cassander in Macedonia, by whom he was sent on an exploring expedition down the Red Sea and along the southern coasts of Asia. After his return he published a work called *The Sacred History,* which he professed to base on his discoveries in the island of Panchæa. Its main proposition was that all the gods were merely men who had in their time been distinguished as warriors, inventors, or benefactors of mankind, and who had therefore been deified. He applied this method of intrepretation to all the Greek mythology, saying, for example, that Zeus had been a conquering king of Crete. His work is lost.

From Euhemerus this method of criticism of legends has been called Euhemerism. Its strength, as a general principle, lies in the fact that all races have a tendency to deify their heroes, whose qualities become magnified with the lapse of time. The beatification and canonization of supremely pious people show us this tendency at work throughout the Christian era. The chief modern exponent of this method of interpretation was the Abbé Banier, in the eighteenth century. In the past two hundred years a euhemeristic interpretation has been given to the widespread traditions of 'little people,' which are held to have had their origin in actual dwarf races, still represented by surviving remnants in

various parts of the world. Consult Tylor's *Primitive Culture;* Block's *Euhémère et sa Doctrine;* Blas' *Quæstiones Euhemereæ* (Dissertation, University of Amsterdam, 1902).

Eulenburg, Botho, Count (1831–1912), German statesman, born in Wicken, Friesland. He was educated at the Universities of Königsberg and Bonn (1849–52). He served as a member of the Prussian Lower House (1863–70 and 1879–81), Minister of the Interior (1878–81), and president of the Prussian ministry (1892–4). In 1899 he took his seat in the Prussian House of Lords. He is a Knight of the Orders of the Black Eagle and of the Prussian Crown.

Eulenspiegel, Till, seems to have been a peasant from Kneitlingen in Brunswick, who died at Mölln, near Lübeck, in 1350. The earliest editions of his *Jests* were in Low German, of the years 1483, 1490, 1500, approximately. This collection of jests was one of the most popular books of the sixteenth century. H. Sachs and J. Ayrer often utilized it; it was translated into English (1530). Fischart issued a version in rhymed couplets in 1572, which represented a great improvement both in matter and in form; he draws freely on his vast knowledge of popular expressions, proverbs, etc., and introduces vigorous satire, especially of the university and the church. A modernized version was published by Simrock; and a cheap edition, with introduction and notes, was edited by R. Michel. De Coster's book on the legend, first published in 1867, and reissued in an enlarged form in 1893, is of considerable value.

Euler, Leonhard (1707–83), Swiss mathematician, was born in Basel. He became a pupil of John Bernoulli, and was admitted to the St. Petersburg Academy of Science (1727). Appointed professor of natural philosophy (1730), three years later he became professor of mathematics, and in 1736 the academy published his *Mechanica sive Motus Scientia.* In 1741 he went to Berlin, at the invitation of Frederick the Great, to assist in founding an academy there. His *Scientia Navalis* was issued by the St. Petersburg Academy in 1749; and was republished, considerably expanded, in 1773, with the title *Théorie Complète de la Construction et de la Manœuvre des Vaisseaux.* A selection from his numerous contributions to the St. Petersburg Academy journal has been published separately, entitled *Opuscula Analytica* (1783–5). His name is perpetuated in various mathematical formulæ. Among his remaining works are the *Introduction to Algebra* (1770) and *Lettres à une Princesse d'Allemagne.* Consult Rudio's *Leonhard Euler.*

Eulophia, a genus of terrestrial orchids belonging to the Vandeæ. They have membraneous, grassy leaves, and their flowers have a handsome three-lobed albellum marked with ridges and furrows. These orchids are potted much as ordinary plants. *E. maculata* has white, pink, and crimson spotted flowers.

Eumæus was the faithful swineherd of Odysseus in Greek story. On his return to Ithaca, Odysseus revealed himself to Eumæus before he made himself known to his wife, and was helped by him in slaying the suitors of Penelope. Consult Homer's *Odyssey.*

Eumenes of Cardia was the private secretary of Philip of Macedon and Alexander the Great. On the death of the latter he became ruler of Cappadocia, Paphlagonia, and Pontus in 323 B. C. He then carried on war for some years against Antipater, and afterward against Antigonus, to whom he was surrendered by some of his troops in 316 B. C. He was then put to death.

Eumenes I., king of Pergamus in Asia, from 263 to 241 B. C.—Eumenes II., king of Pergamus from 197 to 159 B. C. He allied himself with the Romans, and under his rule Pergamus attained to great prosperity. He founded there a famous library which rivalled that of Alexandria.

Eumenides (also called Erinyes by the Greeks, and Furiae and Dirae by the Romans) were in ancient mythology the avenging deities. The name Erinyes is the older one. It was at first merely an attributive epithet of the murdered person's ghost, which haunted the murderer till he took refuge in a land whose soil was not soaked with the blood of the dead. Homer gives them no form, but Æschylus personifies them, and connects them, by a prudent euphemism, with the Eumenides. This term means 'the kindly ones,' and was used to avoid pronouncing their awful name. Thereafter they were thought of as the daughters of Earth or of Night, and are depicted as winged maidens of awful aspect, with snakes entwined in their hair and blood dripping from their eyes. Their number is usually given as three, their names being Tisiphone, Alecto, and Megæra. They pursued men for many crimes, but especially for bloodshed. Æschylus' play *Eumenides* gives a vivid account of them.

Eumolpus, in Greek mythology, was a Thracian poet, the son of Poseidon. After various adventures he came to Eleusis in Attica, and was kindly received by the people there; but while fighting with them against the Athenians was killed by Erechtheus, the Athenian king. He was held to have founded the Eleusinian mysteries; and his descendants, the Eumolpidæ, were the priests of Demeter at Eleusis till the latest times.

Eunomius (d. 394), was born in Dacora, Cappadocia. In the year 360 he was appointed bishop of Cyzicus, but was deposed four years later, in consequence of extreme Arian views, and afterward banished by the Emperor Theodosius. He was expelled from Cæsarea, whence he retired to Dacora, his birthplace, where he died. His writings were destroyed by order of the emperor, and the Eunomian heresy was condemned by the Council of Constantinople. His *Apologies* have been recovered from the refutations of Basilius and Gregory of Nyssa.

Eunuch, a man rendered incapable of sexual reproduction by means of a surgical operation. From the Egyptian and Babylonian period to the present day, Oriental potentates have been accustomed to put their women under the charge of eunuchs, a custom which was adopted also by the later Roman emperors. These eunuchs often acquired great political influence, and were appointed to the highest offices of state. Eumelus, one of the early rulers of Pergamus, was a eunuch; so was Narses, who recovered Italy from the Goths for Justinian. Agha Muhammad, founder of the present dynasty of Persia, had been made a eunuch in early life.

In modern Europe eunuchs were, till recently, in demand as singers; this was only put a stop to when Pope Leo XIII., on his accession (1878), prohibited the employment of *castrati* in the papal choir. Religious fanatics have often practised self-mutilation. The Russian Skoptzis are an instance in our own day. Origen (185–253) is the only self-made eunuch of any mark. See Castration.

Euomphalus, a genus of fossil gasteropod shells, mostly flattened and disc-shaped, with a wide and open depression or umbilicus on the under surface. The mouth is angular, not rounded, and on the upper lip there is a narrow slit which passes on to the outer surface of the shell. This is decorated with prominent spiral ribs. Euomphalus is a characteristic fossil of the older formations, ranging from the Ordovician to the Trias, and is abundant in many Carboniferous limestones.

Euonymin, an extract from the bark of the wahoo or spindle tree (*Euonymus atro-purpureus*), is used medicinally as a powerful stimulant to the liver, with a mild cathartic action on the intestine. It should be followed in the morning by a saline.

Euonymus, a genus of trees and shrubs belonging to the Celastrineæ. They produce small whitish, purplish, or greenish flowers in axillary cymes. The members of the genus are popularly known as spindle trees or burning-bushes by reason of the brilliant colors of their capsular fruits, disclosing, when opening, the orange-colored seeds. *E. atro-purpureus*, the 'wahoo,' with lobed, red fruit; *E. Americanus*, with tuberculate scarlet pods, known as 'strawberry bush'; and the European 'spindle tree' (*E. Europæus*), with four-lobed scarlet fruits, are commonly planted and easily cultivated. The evergreen, *E. Japonicus*, has pink fruits and many varieties. As they mostly bear clipping well, they are useful plants for fences or edgings.

Eupatoria, seaport on west coast of Crimea, Russia; 42 miles northwest of Sebastopol by sea. Under the khans of the Crimea it was a flourishing place, and enjoyed a large trade in wool and leather. The mosques, walls, and bazaars are among the finest relics of the old Tartar civilization of the Crimea; in particular the mosque of Juma-Jami, built in 1552. Cereals and salt are exported. Pop. 18,000—this number includes many Jews, the Karaite sect having here their principal synagogue.

Eupatorium, a genus of composite plants, mostly natives of America. The most striking species is the Joe-Pye-weed (*E. purpureum*) of American marshes, which rears its massive, faded-purple head fully 10 feet above the ground at times. Its stem and the petioles of the great whorls of oval leaves are also flushed with maroon, or are more rarely green. The famous 'boneset' (*E. perfoliatum*) attains to five feet, and has connate-perfoliate leaves, and crowded

Boneset (Eupatorium perfoliatum).

heads of white flowers. The whole plant is whitened with pubescence, and furnishes a popular 'tea,' a remedy for colds. A more delicate species, with looser heads of pure white flowers, is the white snake root (*E. ageratoides*). Its broad leaves have long petioles.

European Eupatorium.
1, Capitulum; 2, flower; 3, seed.

Eupatridæ was the name given at ancient Athens to the landed nobility of the country, who, after the abolition of the ancient monarchy, were the ruling class in Attica until the time of the reforms of Draco in 621 B. C.; until that time they alone could hold and elect to the one office—the archonship. The reforms of Solon in 594 B. C. entirely destroyed their political position.

Eupen, town, in former province of Eupen-et-Malmédy, Belgium. The town has important cloth and woolen industries, dye works, and yarn-spinning mills. By the terms of the Treaty of Versailles the province and Moresnet were ceded by Germany to Belgium on June 16, 1919; on May 18, 1940, by decree of Hitler, the province was once more annexed by Germany. Pop. (town) 15,000; pop. (province) 64,000.

Euphonium, a modern brass wind instrument of large form, belonging to the saxhorn family.

Euphorbia, a large genus of plants of very wide distribution,

Euphorbia Helioscopia.
1, Involucre, with flowers, male and female; 2, male flower—*i. e.*, stamen.

mostly occurring in deserts or dry, sandy land. Most of them have a milky juice, sometimes very poisonous. They are occasionally armed, and resemble cacti. Among the species are shrubs and herbs of all sizes, the characteristics common to all the members of the genus being the possession of a cup or bell-shaped involucre, within which is a ring of numerous staminate flowers,

each consisting of a single stamen without perianth, within the ring being a tripartite pistil.

Among the species is *E. helioscopia*, the sun spurge, a naturalized weed easily recognized by the greenish-yellow color of its umbel. *E. lathyris* is the caper spurge, or mole plant, which is sometimes grown in gardens and its capsules pickled. The 'snow on mountain' (*E. marginata*), with white-edged bracts, and the peculiar cypress-spurge (*E. Cyparissias*), crowded with soft linear leaves and large heads of yellowish bracts, have escaped from gardens into waste places. The wild ipecac (*E. Ipecacuanhæ*) is a native spreading plant, used as an emetic; the flowering spurge (*E. corollata*) has a tall stem with narrow leaves, and white, petal-like appendages on its involucres.

The poinsettia, common in florists' windows, possessing gorgeous scarlet upper leaves 6 inches long, is also a tropical spurge (*E. pulcherrima*).

Euphorbium, or EUPHORBION, a term sometimes applied to the juice of several species of the Euphorbiaceæ, improperly called a gum-resin. Except in minute doses, this is a violent irritant to the respiratory and alimentary tracts, causing purging, vomiting, running at the nose, etc. *Euphorbia pilulifera* (snake-weed or cat's hair of Australia) is used in the form of a tincture, extract, or decoction for many respiratory troubles, such as asthma, whooping-cough, bronchitis, etc. It seems to act upon the nerve centres for breathing and for the heart. Some therefore recommend it for angina pectoris also.

Euphorbus, son of Panthous, was one of the bravest of the Trojans; Menelaus slew him (*Iliad*, xvi.). The philosopher Pythagoras, who believed in the transmigration of souls, claimed that he had been Euphorbus (Ovid's *Metamorphoses.*, xv.).

Euphranor, ancient Greek sculptor and painter from about 360 to 335 B. C. His most famous work was a Paris, of which the seated *Paris* in the Museo Pio-Clementino at Rome is a copy. As a painter his coloring and proportion were celebrated.

Euphrasia. See EYEBRIGHT.

Euphrates, called in the Old Testament Phrat, and now El Frat, is the most important river in Asiatic Turkey. It rises in two branches in the mountains of Armenia. The western arm, Kara-su ('black river'), has its source in the Dumlu-dagh, 20 miles northwest of Erzerum, and flows in a southwesterly course through the plain of Erzerum, past the town of Erzingan, to which place it is navigable for small rafts. From its source to its union with the Murad-su, its length is 275 miles. The Murad-su, the eastern branch, rises in the Aladagh range, between Lake Van and Mount Ararat, and flows west for 415 miles till it joins the Frat near Keban Maden, noted for its lead mines. The united stream now takes a southerly course, and bursting through the Taurus range, traverses beautiful scenery to Samsat—to which place at one time the river was navigable for steamers. After leaving Samsat it flows south and southeast through a treeless, uninteresting, and sparsely peopled district, past Birejik (100 miles from the Mediterranean Sea), Deir, Ana, and Hit. Its length from Samsat to Hit is 710 miles. The course of the river is then southeast past Hilleh and the ruins of Babylon, until it reaches Korna, where it unites with the Tigris to form the Shat-el-Arab, which, 100 miles farther south, falls into the Persian Gulf 60 miles below Basra.

Of little practical utility, the Euphrates is navigable for ocean-going steamers to a point only fifty miles above its confluence with the Tigris. In flood

Bartholomew, Edin.

time a river steamer ascends as far as Meskeneh. The decay of the ancient irrigation works, which once made the Euphrates valley a vast expanse of fertile country, together with the bursting (1834) of the neglected embankments, and the consequent spreading out of the river into wide pestilential marshes, has destroyed both the source of its once great trade and the navigable value of the stream. Its length is about 1,700 miles, and the area of its basin 260,000 square miles.

Steamship service was established in 1910. It is greatly hindered, however, by interference from the Arabs on the river banks. The Euphrates was the farthest limit of the land of Israel to the east. In the Bible it is called 'the river' (Ex. xxiii. 31) and 'the great river' (Deut. i. 7).

Euphrosyne. See CHARITIES.

Euphuism, ū'fū-ism, a term used to describe the extremely florid style employed by many of the Elizabethan prose writers. The name is derived from *Euphues,* a novel published in 1579 by John Lyly. As a matter of fact, however, a somewhat similar development was proceeding in every country of Europe at the time, and was inevitable as soon as prose became self-conscious. Euphuism was characterized by a balanced structure of clause and epithet, and an excessive use of similitudes drawn from fabulous natural history. It is satirized in Scott's *Monastery.* See LYLY, JOHN.

Eupolis, ū'pō-lis (*c.* 446–411 B.C.), one of the chief Athenian poets of the so-called Old Comedy. He was a contemporary and rival of Aristophanes, whom he more than once defeated. None of his works survives, but many fragments are extant. He seems to have possessed the same freedom in attacking individuals, and much of the same wit and humor as Aristophanes, with whom and Cratinus he is classed by Horace as a representative of the Old Comedy.

Eurasian, ūr-ā'shan, an adjective compounded of European and Asian, used sometimes to denote the whole continent of Asia and Europe, 'the Eurasian continent,' but chiefly applied substantively to the mixed race that has arisen in India from the union between Europeans and natives. Officially, they are now termed Anglo-Indians.

Eure, ûr, department of northwest France, in Normandy. Its area is 2,330 square miles and its largest dimension is 70 miles from east to west. The surface forms a slightly inclined plateau, 800 feet high in the southwest, and is more or less intersected by valleys. The Seine cuts off the northeast corner. The Eure, a left bank tributary of the Seine, and its affluents drain the south and center. Wheat, oats, mangolds, apples, and beet root are the principal crops. Cattle, sheep, and horses of the pure Norman breed, for which the department is famed, are reared in considerable numbers. Manufactures of textiles are carried on throughout the department. Evreux is the capital. Pop. (1936) 303,829.

Eure, river, France, a tributary of the Seine, rising in the department of Orne. It flows first southeast, then north and northwest, and after a course of about 110 miles enters the Seine above Pont de l'Arche.

Eure-et-Loir, ûr-ā-lwär', department of northwest France, covering an area of 2,291 square miles, and formed out of parts of Orléanais, Normandy, and Ile-de-France. The eastern portion is generally flat, the center and southeast—the Beauce—being a rich plain; the west is hilly and forested, with numerous fertile valleys; in the southwest, on the Upper Loir is the Perche, on whose meadows fine cavalry horses are reared. The chief rivers are the Eure and the Loir. The department is regarded as the granary of the Seine. There are flour mills on the Loir and Eure, textile factories in the valley of the Eure, and iron works, cotton, and paper factories. Chartres is the capital. Pop. (1936) 254,790.

Eureka, Greek, 'I have found it,' the reputed exclamation of Archimedes (q. v.) when he discovered, in a flash, the principle that a body immersed in a liquid loses weight by an amount exactly equal to that of the liquid displaced. The idea occurred to him in the bathtub.

Eureka, u-re'ka, city, California, in Humboldt county, on Humboldt Bay, and on the Northwestern Pacific Railroad; 297 miles N.W. of San Francisco. It is in the redwood region of the State, and its principal industry is the milling and shipping of this lumber to San Francisco, Hawaii, and Australia. There are also manufactures of woolen goods, leather, and foundry and machine-shop products. Pop. (1930) 15,752.

Eureka, city, Utah, in Juab county on the Denver and Rio Grande Western and the Union Pacific Railroads; 87 miles S.W. of Salt Lake City. It is a flourishing mining center, with smelters, quartz mills, and mines of gold, silver, lead, and copper. Pop. (1930) 3,041.

Eureka, city, Kansas, county seat of Greenwood county, on the Fall River, and on the Atchison, Topeka, and Santa Fé and the Missouri Pacific Railroads; 40 miles S.W. of Emporia. It has natural gas; is an important cattle market. Pop. (1930) 3,698.

Eureka Springs, city, Arkansas, county seat of Carroll county, in the Ozark Hills, at an altitude of 1,800 feet, on the Missouri and North Arkansas Railroad; 250 miles N.W. of Little Rock. It is a popular health and pleasure resort, noted for its healing springs. Pop. (1930) 2,276.

Euripides, ū-rip'i-dēz (485 or 480–406 B.C.), Athenian tragic poet, was born in 480 B.C., though the Parian marble gives the year of his birth as 485. It is probable that he was born on the island of Salamis. He was a friend of Anaxagoras, and later of Socrates. His last years were spent at the court of Archelaus, king of Macedonia, where he died —it is said from wounds received from dogs maliciously set on him. Only seventeen of his plays are now extant, excluding the *Rhesus* (probably a later composition); but the titles of sixty-eight in all are known. In forming an estimate of his genius, it is necessary to guard against the prejudiced criticism of Aristophanes and other ancient critics, who resented his innovations, and—as seems probable—wilfully misunderstood his real attitude. It is in his *Frogs* that Aristophanes compares Æschylus and Euripides, much to the latter's disadvantage. Apart from verbal and metrical criticisms, his attack is mostly directed against the poet's morality; but examination shows that he chooses to regard as the poet's own, the morality of his characters, and even that he perverts.

Euripides differed from his predecessors in being a more learned poet. He was abreast of the scientific and philosophic thought of his age, and loved to expound his views in his plays; these views often approached to a religious scepticism hateful to conservatives like Aristophanes. He was also a realist, using in his dialogue the language of the day, and making his characters resemble those of real life. It is clear that he was not popular in his own day, as he won the first prize in the tragic contests only four times; but in the fourth century and afterward his popularity equalled or surpassed that of his rivals. It is perhaps as a master of pathos that he is supreme; and he is also distinguished by his delineation of female character. His strongest and noblest characters—Medea, Phædra, Alcestis, Macaria, Iph-

igenia, Polyxena—are all women; and the nobility of some of them strongly contradicts the story that he was a misogynist. His best plays are the *Hippolytus, Medea, Alcestis, Ion, Bacchæ,* and *Iphigenia in Aulis.* The last two were brought out after his death, and were probably his latest works. The *Alcestis* was produced in 438 B.C., and the rest of the extant tragedies between that date and 406; and it is impossible to trace in them any development of his genius. His skill as a playwright is of the highest order; he can construct plots which are exciting beyond anything attempted by his predecessors, and he has an unerring instinct for a 'situation.' But he has all the unscrupulousness of the practical playwright: in his consuming desire to get on to the situation as rapidly as possible, and to bring the curtain down sharp on it, he substitutes a bald prologue for a proper exposition, and, instead of working out the *dénouement,* makes a *Deus ex machina* cut the knot of the situation. His plays were 'revived' on the stage more frequently than those of Æschylus or Sophocles. Milton, Browning, Schiller and Alfieri, were ardent admirers of the work of Euripides.

Consult J. P. Mahaffy, *Euripides;* J. A. Symonds, *Greek Poets;* A. W. Verrall, *Euripides the Rationalist* and *Essays on Four Plays of Euripides;* P. Décharme, *Euripides;* G. Norwood, *Riddle of the Bacchæ;* G. Murray, *Euripides and His Age* (1914); W. N. Bates, *Euripides* (1929). The best edition of the text is Nauck's; the best complete edition in English of all the plays is Paley's. Good editions of separate plays are Earle's *Alcestis;* Sandys' *Bacchæ;* Mahaffy and Bury's *Hippolytus;* Harry's *Hippolytus;* Verrall's *Ion;* England's *Iphigenia in Aulis;* Verrall's *Medea* and *Bacchantes;* Allen-Moore's *Medea;* Wedd's *Orestes.* Weil (French) has an edition of seven plays. Translations: in verse by Way; Browning's *Balaustion* (a free rendering of the *Alcestis*); in prose, Coleridge; Gilbert Murray's verse translation.

Euripus, or EURIPOS. See EUBŒA.

Eurite, ū'rīt, an acid, igneous rock of the granite group, consisting of quartz and feldspar, with muscovite or garnet as accessory minerals, and mostly found as dykes and veins traversing granite and crystalline schists. It is usually finer grained, paler colored, and richer in quartz than granite.

The name has also been given by various authors to rocks of considerably different composition and appearance. The term is of French origin, and is sometimes used as a synonym for *granulite* and *felsite.*

Euroclydon, ū-rok'li-don, the name applied in the Acts of the Apostles to the cold, tempestuous wind that wrecked St. Paul. It is probably the *bora* (q. v.) that is referred to.

Euro'pa, in ancient Greek mythology, daughter of the Phœnician king Agenor, or, according to Homer, of Phœnix. Zeus was charmed by her beauty, and in the form of a bull mingled with the cattle while Europa and her maidens were playing on the shore. His tameness enticed Europa to mount on his back, when he swam away with her to Crete, and became, by her, father of Minos, Rhadamanthus, and Sarpedon.

Europa Point, the extreme point of the cape upon which Gibraltar stands. See GIBRALTAR.

Europe, the smallest (except Australia) of the continents.

Confines and Dimensions. —The boundaries of Europe and Asia are not defined so clearly as those between the other continents. Although some aspects of the geography of Europe have led to its being called a mere peninsula of Asia, its history and the distribution of population have established its individuality as a continent. The crest of the Urals and that of the Caucasus may be taken as the eastern and southeastern boundaries of Europe. (The political boundary between Europe and Asia extends some distance beyond the Urals, to include the mining regions; and some authorities prefer to accept the Manych depression, north of the Caucasus, as the southeastern line. See CONTINENT). Within these boundaries, and reckoning Novaya Zemlya and Spitsbergen as well as Iceland with Europe, the total area is about 3,820,000 square miles, or about one-fourteenth of the land surface of the globe. Its length from the North Cape, 71° 12′ N., to Cape Matapan, in the south of Greece, 36° 23′ N., is about 2,400 miles, and its breadth from Cape St. Vincent in Portugal to the Ural mountains near Sverdlovsk is about 3,300 miles. The rough coastal length, neglecting minor indentations, is about 20,000 miles, or three and a half times the minimum possible periphery. If minor inlets are included, the length is probably nearly 50,000 miles. The

Area and Population of Europe

Country	Area in sq. m.	Population		Density per sq. m.
Albania	10,629	1,003,124	(1930)	94.4
Andorra	191	5,231	(1936)	27.4
Austria	32,369	7,009,014	(1939)	216.5
Belgium	11,775	8,386,553	(1939)	712
Bulgaria	39,825	6,077,939	(1934)	153
Czechoslovakia	54,244	14,729,536	(1930)	271.5
Danzig	754	415,000	(1939)	550.4
Denmark	16,575	3,706,349	(1935)	224
Eire (Ireland)	26,600	2,965,854	(1936)	111.5
Estonia	18,353	1,126,413	(1934)	63.37
Finland	134,557	3,667,067	(1930)	27.3
France	212,659	41,907,056	(1936)	197
Germany	181,699	69,622,483	(1939)	383
Great Britain and Northern Ireland	95,030	47,290,245	(1937)	497.6
Greece	50,270	6,204,684	(1928)	123.4
Hungary	45,230	10,817,286	(1939)	239.1
Italy	119,714	44,394,000	(1939)	370.8
Latvia	25,395	1,950,502	(1935)	76.8
Liechtenstein	65	10,213	(1930)	157
Lithuania (including Memel)	55,670	2,526,535	(1937)	45.4
Luxembourg	999	296,913	(1935)	297
Monaco	370 acres	23,973	(1939)	
Netherlands	12,698	8,728,569	(1939)	686.5
Norway	124,556	2,814,194	(1930)	22.59
Poland	150,052	34,221,000	(1937)	228
Portugal	35,490	6,825,883	(1930)	192.3
Roumania	113,884	19,422,660	(1937)	170.55
Russia (Europe)	1,492,000	108,100,000	(1931)	61
San Marino	38	14,545	(1939)	382.7
Spain	196,607	25,240,971	(1939)	128.3
Sweden	173,347	6,310,214	(1939)	39.8
Switzerland	15,944	4,066,400	(1930)	255
Yugoslavia	95,558	15,400,000	(1938)	145.8
Total (in round numbers)	3,560,000	505,200,000		141

Europe

mean elevation of Europe is 1,080 feet. More than half the surface lies less than 600 feet above the sea, so that the proportion of lowland is greater than in any other continent. Most of this lowland is in the east, but a band stretches west, south of the Baltic and North Seas, to the Bay of Biscay.

Physical Divisions.—Europe consists of three well-marked divisions. (1) In the east are flat or gently undulating lands, rising nowhere over 1,160 feet, except in the Urals. The area of this division is half that of the Continent. (2) In the south are the lofty mountain chains whose highest points are in the Alps (15,780 feet) and Caucasus (18,530 feet). They extend from the Sierra Nevada of Spain to the Caucasus, bending round great flat plains or deep seas. (3) In the center and northwest are two highland groups, the former rising to 5,250 ft., the latter to 8,400 ft., separated by a band of lowlands and shallow seas.

The rocks of the E. lowlands lie almost horizontally; those of the rest of Europe are folded, contorted, and fractured usually in a very complicated manner. In the S. mountains the predominant features are structure lines due to recent foldings and fractures affecting rocks of all ages; but in the central and N. highlands the foldings are of Palæozoic date, and rarely determine the features, which have been carved and modelled by denudation and deposition. The S. mountains separate the N. regions of cold winters and well-distributed rainfall from the Mediterranean region of cool, rainy winters but dry summers. The E. is distinguished from the central and N.W. by its great extremes of temperature and relatively dry winters, and the uniformity of its relief brings about uniformity of climate and vegetation over vast areas. The central lowlands are more continuous and uniform than the isolated plains of the S. The influence of these three physical divisions can be traced in all phases of European geography.

Eastern Europe is bounded by old crystalline rocks which appear in Finland and the Urals, in the Carpathians and Caucasus. These E. lowlands form one of the stable areas of the earth's crust. Long-continued denudation has reduced the relief to slight land swellings, of which the Valdai Hills (1,150 ft.), the hydrographic center of Russia, its S.W. continuation the W. Russian height of land (1,120 ft.), the morainic Baltic heights (1,050 ft.), and the scarped ridge which forms the r. bk. of the Volga (1,155 ft.), are the most important. The N. Russian height of land which forms the divide between the N. Dwina and the Volga rises only to 623 ft. The bordering Urals are a denuded highland, whose rocks were folded in Palæozoic times. The surface features of the E. lowlands are determined by their superficial covering of glacial waste N. of a line from the N. of the Carpathians to the Kama, and the fine black earth (*chernoziom*) in the S., covered with alluvium in the N. of the Caspian, which lies near or under sea-level. The glaciated area may be divided into a S. or older region with no lakes, representing the greatest extension of ice during the ice epoch, and a younger region, N.W. of a line from the Narev to Cheskaya Bay, which is studded with innumerable lakes, and forms the Russian part of the Baltic heights.

Northwestern and Central Europe.—To the N.W. the Palæozoic rocks form an escarpment above the Archæan region of Finland and E. Scandinavia. Suess has called this a 'glint' line. It can be traced from the White Sea, by the great lakes, the Gulf of Finland, to Kalmar in S. Sweden, where it curves W. and then N., bisecting the great valley lakes of Sweden, and runs to the White Sea by the Varanger Fiord, completely surrounding the Baltic Archæan shield. This Archæan shield and its limiting glint line are homologous with the Hudson shield of Canada and its bounding escarpment, which can be traced through the N. American great lakes. Both are gently undulating, lake-dotted, and forested regions.

Still farther to the N.W. the land rises to the Scandinavian highlands, whose rounded superficial forms are due to denudation. Ice action has been especially potent, as is evidenced by the mammillated rocks (*roches moutonnées*), the hanging valleys, the valley lakes on the E. and fiords on the W., the long åsar and drums and morainic deposits round its E. and S. base. Glacial activity still continues in the higher regions.

Although we regard Scandinavia as a denuded highland, we find two sets of crustal foldings of very ancient date, the younger on the mainland probably of late Silurian ages, the older in the Lofotens and the extreme N.E. of the mainland of pre-Cambrian date. In the British Isles, which are separated by the North Sea, shallow except for the deep Norwegian trough or depression, the Scandinavian structure reappears. Similar gneisses to those of the Lofotens are found in the Outer Hebrides and in the N.W. of Scotland. Indeed, the highlands of Scotland resemble the Scandinavian plateau, except that they are lower. The N. and W. of Ireland, the S. of Scotland, Cumberland, and all Wales, except the extreme S., have their structure and feature lines running from S.W. to N.E., and may be grouped with the highlands of Scotland and Scandinavia as the Caledonian area.

The third important Palæozoic folded region, the Armorican-Variscan area, with post-Carboniferous foldings, is also mountainous, owing to Tertiary upliftings and sinkings, and can be traced throughout the central highlands of Europe. The direction curves from W. to E. in the S. of Ireland, Wales, Cornwall, and Brittany, to W.N.W. to E.S.E. in the central plateau of France (Armorican system), where the axis of folding alters to W.S.W. to E.S.E. and dominates the other highlands of the Rhine, Weser, and Elbe (Variscan system). This region is broken up into groups by crustal depressions. Those of the English Channel and its gulfs separate the highlands of (1) Kerry-Cork, (2) S. Wales, (3) Devon-Cornwall, (4) Britanny (Brittany). The central plateau of France is surrounded by the basins of the Gironde, Seine, and Rhône, with *cols* between; that of Poitou attaches it to Britanny in the N.W., that of Langres to the Rhine highlands in the N.E., while the Saône-Rhône flows at the foot of the fault escarpment of Morvan and the Cevennes.

The Middle Rhine highlands are divided by a great rift into the Vosges in the W. and the Black Forest (Schwarzwald) in the E. The northern extension of this rift, forming the Hessian strait, is blocked by the recent volcanic mountains. To the W. are the Rhine schist highlands, through which the Rhine has cut a picturesque gorge, and their W. continuation the Ardennes. The Thuringian depression has the Harz block to the N., and that of the Thuringian Forest to the S., the latter sinking to the Franconian depression, crossed by the escarpments of the German Juras, which, like the limestone and chalk-scarped ridges of England and the Seine basin, reveal the predominating lines of weakness which have always affected this region.

In the E. the ancient mass of Bohemia has sunk in the N. to form a basin bordered by the Erzgebirge and Sudetic Mts. The Naab and Moldavian depressions in the S. delimit the Bohemian Forest and the less marked Moravian uplands which form the S. boundaries of the Bohemian diamond. The Erzgebirge have the S.W. to N.W. feature

Europe

lines of the W. highlands, the Sudetics and Bohemian Forest the S.E. to N.W. feature lines which characterize the Thuringian Forest and the Harz, and are known as the Hercynian lines. In Poland, Podolia, and Volhynia much lower uplands are encountered.

The lowlands between the Caledonian and Armorican-Variscan regions are probably all folded in sympathy with those of the one or of the other; but this is not always revealed at the surface, most of which is formed of morainic deposits. The lowlands are divided by the line of lake-studded Baltic heights, and its probable continuation in the Dogger Bank. To the N. are the Baltic and northern North Sea; to the S. are the central plain of Germany, the Netherlands, and the southern North Sea. The Baltic and North Seas are kept apart by the Schleswig height, the E. part of the lowlands from the marshy W. regions, sloping gradually down to shallow seas by the Lüneburg Heath.

Southern Europe.—The Pyrenees, Alps, Carpathians, and Caucasus indicate the N. limit of mountain ranges, wherein rocks of all ages up to early or mid-Tertiary times are folded. Their continuity is broken by great depressions, which form the basins of the Black Sea and Mediterranean Sea and the Hungarian Plain. Between the outer ranges are masses of older highlands which have been retained at considerable elevations in the plateaus of the Balkan and Iberian Peninsulas. Sardinia and Corsica may be regarded as remnants of another highland mass, most of which is now sunk beneath the Tyrrhenian Sea.

Beginning in the W., the Pyrenees and their W. prolongation, the Cantabrian Mts., form the N. border of the Iberian Peninsula. Their relationship to the other young folded chains has not yet been clearly established. The crustal movements which led to their folding took place in early Tertiary times, and later disturbances took the form of fractures. To the S. is the old highland or Meseta, with old foldings parallel to the Armorican strike. The E. escarpments (the Iberian Mts.) rise above the basin of the Ebro, and the S. escarpments (the Sierra Morena) rise above that of the Guadalquivir. The latter, which forms the plains of Andalusia, lies between the Meseta and the young folded Betic cordillera, of which the Sierra Nevada is the most important range. To the E. this chain can be traced in the Balearic Is.; in the W. it curves S., is ruptured at the Strait of Gibraltar, and continues as the Er Rif range of the Atlas. The Atlas ends abruptly at the strait of Sicily, and the folded band can be traced through the N. of that island, and throughout the Apennines. On the inner margin of the depression, between the Atlas and Apennines, are recent volcanic areas, still increased by Vesuvius, Stromboli, and Etna. The Alps form the central chain of this mountain band, and in the E. the ranges diverge; the N. ones are connected by the Little Carpathians with the Carpathian chain, which, with its continuation, the Transylvanian Alps, encloses the Hungarian Plain, while the S. ones trend to the S.E. as the Dinaric or Illyrian, Albanian, and Grecian Mts., and form the W. boundary of the Balkan Peninsula. Here, as in Spain, an older highland—that of Servia, Macedonia, and Thrace—has been caught up between the folded mountain chains, the Dinaric-Albanian on the W., and the Balkan on the N. The Balkans are a continuation of the Transylvanian Alps, just as Er Rif is a continuation of the Sierra Nevada. The Klisura gorge of the Danube represents the Strait of Gibraltar. The Yaila Mts., in the S. of the Crimea, and the Caucasus Mts. are separated from each other, and from the Balkans, by the Black Sea, to the S. of which the mountains bounding Asia Minor represent the E. prolongation of the rest of the Balkan Peninsula, the S. limit being marked by the islands of Crete and Cyprus.

Climate.—Europe is well favored climatically. From its situation in the N.E. of the Atlantic Ocean, and N.W. of the Old World, it receives warm winds from a sea which is abnormally warm in winter, owing to the currents which drift before the W. winds. This mild climate permits the use of all the W. seas and gulfs, except the Baltic, all the year round; and these inward extensions of the ocean aid in assuring a mild climate to the W. half of the Continent. In winter the temperature diminishes from S.W. to N.E., but in summer from S. to N. The W. is equable, the E. extreme in temperature, and the S. mountains protect Mediterranean lands and ensure a mild winter.

The winds are controlled from three centers of atmospheric action—a permanent law pressure over the N. of the Atlantic, a permanent high pressure W. of the Azores, and an Asiatic center which is low in summer but high in winter. The Atlantic low and high pressures are so situated that they combine to direct S.W. winds on W. Europe. In winter the Asiatic high pressure prevents these winds from penetrating beyond the W. coasts, to which they carry abundant rains. The E. remains dry in winter, but has rain in summer. The S. lies within the trade-wind area in summer, when it is dry, but receives spring and autumn or winter rains, due to the relatively low pressure which forms over the Mediterranean, and determines the inflowing of moist air.

Four climatic regions may be distinguished: The *Northern* or *Arctic Region*, which comprises a small strip along the N. coast from North Cape to the Kara Sea, where the mean monthly temperature is never over 50° F. The *Western* or *Atlantic Region*, N. and W. of a line from the Minho by the Cevennes and Alps to the mouth of the Oder, and thence along the crest of Scandinavia. The frost period does not last more than one month in the year except on the E. confines; the annual range of temperature is under 30° F. Rain falls at all seasons, but most abundantly in winter or autumn. The *Eastern* or *Continental Region* has more than two months of frost every year, a temperature range of over 40° F., and the rainfall is scanty —under 30 in., most of which falls in summer. The *Southern* or *Mediterranean Region*, includes parts of W. Asia and N. Africa. There is no continuous frost except in the mountains; the range of temperature is under 30°, with few exceptions; the rainfall is high on the mountains, especially on the W. slopes; the E. slopes and the lowlands are much drier; most of the rain falls in the winter half-year.

Hydrography.—The rivers of the E. lowlands are naturally slow, navigable almost to their sources, and easily connected by canals. They are frozen for several months every year, and the greatest floods occur when the ice breaks up. The rainfall is nowhere very great. The chief hydrographical center is the Valdai Hills, from which the Volga, the longest and largest river of Europe, flows to the Caspian, the Dnieper to the Black Sea, and the W. Dwina (Düna) to the Baltic. The Volga, the Don (which flows to the Sea of Azoff), and the Dnieper have relatively low left banks, but high right banks, which in the case of the Volga are over 1,000 ft. above the sea and river levels. The Vistula (Weichsel), Oder, Elbe, and Weser rise in the central highlands, but run for most of their course across the plain, where they are navigable, and are connected by canals. The Danube is the most important river of the S. mountains, for with its tributaries it drains the E. half of

the Alps, the inner and part of the outer slopes of the Carpathians, the whole of the Transylvanian Alps, and part of the Balkans. It affords a navigable waterway from the margin and larger valleys of the E. Alps to the Black Sea. The Rhine, although it rises in the Alps, is essentially a river of the central highlands and plains.

The rivers of the S. plateaus are short and swift rushing torrents during the rains of autumn, winter, and spring, but low in summer, when many of the minor streams cease to flow.

A belt of morainic heights, with innumerable lakes of all sizes, borders the Baltic, and includes the Russian Ladoga and Onega, the Finnish Saima, and the Swedish Wener, Wetter, and Mälar. Valley lakes fringe the E. margin of the Scandinavian plateau; they are common in the Scottish highlands and on the borders of the Alps—all glaciated areas. Shallow squarer lakes are found in the soluble limestones of Ireland (Lough Neagh) and in Hungary (Lakes Balaton and Neusiedl). Salt lakes characterize the dry steppe lands N. of the Caspian. A number of small crater lakes occur in the volcanic areas, especially of the Eifel and Italy.

Vegetation.—Five floral belts may be distinguished:

(1.) The Tundra, coinciding with the cold N. climatic belt, producing no cereals and only stunted shrubs, Arctic flowering plants, and many mosses and lichens, of which the reindeer moss is the most valuable. It extends south along the Scandinavian plateau.

(2.) The Temperate Forest Belt occupies all the western and northern part of the east climatic regions, its southern limit in the latter coinciding with that of morainic deposits. Coniferous forests prevail north of 60° N. in the west and north of a line from Lake Onega to the south of the Urals; but in the east, while pine, spruce, and larch prevail, birch and willow represent the deciduous trees. The land stretching south to the southern mountains is characterized by mixed woods. Deciduous trees—oak, ash, beech, elm, chestnut, lime, maple, sycamore, plane, and poplar—are characteristic trees of the lowlands; while pine, spruce, larch, and other conifers, birch, and rowan grow on the hillsides. Much of this land has been cleared for agriculture, except in the more hilly regions, but forest still prevails in the Rokitno swamp and the morainic lake heights, while pine woods have been planted on the sand-dunes of the Landes of France, where they have checked the wandering sands, and permitted great vineyards to be formed.

(3.) The Steppes lie in the southeastern region of scanty summer rains, where the rich black earth forms the soil. The feather-like *Stipa* and other grasses and bulbous plants flourish. Parts of the steppes have been broken by the plough, and grow large quantities of wheat and some maize.

(4.) The Mediterranean Vegetation Region coincides with the climatic one. It is characterized by evergreen plants with leaves whose cuticle or epidermis resists evaporation, or by bulbous and other water-storing plants which can endure the droughts of summer. The economic plants now characteristic of the Mediterranean area were introduced in early times mainly from Asia—*e.g.* olive, orange, lemon, vine, fig, almond, chestnut, mulberry, laurel, myrtle, cypress, and probably also the cereals and the deep rooted lucern. More recently the American aloe (*Agave americana*) and maize from America, and eucalyptus from Australia, have spread over this region.

(5.) The high mountains have a flora approximating to that of the tundra in its general characteristics of dwarf stature and leaves and of bright-colored flowers. Among the common species are the poppy, saxifrage and crowfoot.

Animals.—Europe lies entirely within the Palæarctic animal area. Wild mammals, however, are comparatively rare, except in the northern forests or in the mountains. In these forests the brown bear, fox, lynx, otter, and ermine are found. The chamois lives in Alpine fastnesses. Stags as well as many game birds, such as the grouse, pheasant, and partridge are preserved by the hunting classes. In the breeding of domestic animals Europe leads the world. It produces about one-half the horses in the world; thanks to Russia, almost one-third of the world's sheep; in the number of hogs it is surpassed only by North America; and while Asia leads in the number of cattle, Europe is more careful in the selection. Silkworms are cultivated and fish are propagated. The fish which inhabit the marginal seas, especially the shallow ones, are valuable as food. In the Mediterranean tunny, anchovy, and sardine, in the northwestern seas cod, haddock, whiting, mackerel, herring, sole, flounder, plaice, and many other food fishes, abound. Oysters are cultivated around the coasts; crabs, lobsters, crayfish, and other crustaceans are caught. The large aquatic mammals, such as the seal and porpoise, appear in these waters, but are more abundant farther north, where the whale and the walrus are also caught. Salmon and fresh-water fish are also important.

Population.—The population of Europe in 1934 was about 503,000,000 (out of 1,850,000,000 estimated for the entire globe). This represented a rapid rise in recent times. In the seventeenth century the population of Europe probably did not exceed 100,000,000. At the close of the eighteenth century it has been estimated at somewhat more than 190,000,000; in 1850 at 266,000,000; and in 1900 at 400,000,000. The large gain in the twentieth century was made in spite of the World War and great emigration. Not counting the Soviet Union and the Baltic states, the density of population of Europe is far greater than that of India, which is frequently spoken of as crowded. As for the 'teeming millions' of China—the density of population in that country is far below that of Central, Western, and Southern Europe. The density in Europe, however, varies greatly. Vast areas of the tundra and loftier and more barren mountains and highlands are uninhabited, while in the industrial regions the density is about 1,000 per square mile—for instance, in South Lancashire, or in Belgium. The majority of Europeans belong to the white race. Those in the north and south characteristically possess long, narrow skulls; but the southerner can be distinguished from the northerner by his darker color and shorter stature. A wedge of round-headed people stretches through the central uplands to the eastern plains.

Plant and Animal Products.—Europe is still predominantly peasant, a little more than half of the inhabitants still making their living by farming. The proportion of rural inhabitants is more than 75 per cent in the Soviet Union, Bulgaria, Rumania, and Jugoslavia, and more than 60 per cent in Poland, Hungary, Italy, the Iberian Peninsula, Ireland, and the countries bordering the Baltic. The proportion is markedly low in Great Britain, Belgium, the Netherlands, and Germany.

In spite of its northern latitude and restricted area, Europe is rich agriculturally. With the exception of rice, it is the world's most important producer of cereals. It produces about one-half of the world's wheat and its wood pulp; more than half of the world's supply of oats, barley, apples, grapes, olives, and milk; three-fourths of the world's

Europe

hemp; more than four-fifths of the rye, potatoes, and beet-sugar; 99 per cent of the flax fiber of the world; but less than one-fifth of the world's tobacco crop.

The people of the tundra obtain a precarious living by hunting and fishing. They have domesticated the dog and the reindeer, with whose aid they wander northwards in summer, and in winter southwards to the confines of the northern forest, where hunting may be carried on. Hunting is also the chief occupation in the great pine forests, except where the waterways allow the transport of the timber, resin, or tar obtained from the trees. The water-power of the Scandinavian mountains is utilized for preparing the timber, and for such manufactures as match making and wood-pulp for paper making.

The cleared land of the forest area is cultivated at low levels. Barley is the most important crop in the extreme north, in the clearings of the forest region, and extremely important again in the south, in Alpine lands. Oats form the most important crop on the hilly lands, between 50° and 65°, and are replaced by rye on the lowlands of the mainland, between 50° and 60°. Comparatively little wheat is cultivated north of 55°, the northern limit being 62°. Most of it is grown in Europe between 40° and 50°, although, in the British Isles, it is extensively cultivated 5° farther north. The parallel of 45° is the center of the maize zone. Some rice is cultivated in the plain of the Po, around the Bay of Naples, and in Southern Sicily, as well as on the deltas of the other Mediterranean rivers.

Pulses are widely grown. Potatoes are cultivated, especially in the poorer lands of Ireland, Scandinavia, and the German plain. The sugar-beet is important between 40° and 58° on the Continent, and even farther south in the Danube lands. Flax is raised in the northern part of the Soviet Union, the Baltic States, on the Rhine delta, in Northeast Ireland, and in many parts of Austria. Hemp is cultivated in France, Italy, Austria, and South Russia. Tobacco is grown in many localities south of 55°. The olive, vine, fig, chestnut, and orange are the chief fruits of the Mediterranean region. The vine is also found in favored spots, such as the east of France, the Rhine valley, and most of Hungary. Pastoral lands are plentiful in the west, in all mountainous regions, and north of 55°.

Minerals.—Soviet Russia, drawing on the Urals, is one of the world's principal producers of gold; the Urals also contain 95 per cent of the world's supply of platinum. Silver too is mined in the Urals, and in the Erzgebirge of Saxony and Bohemia, and in Hungary. Mercury comes from the Sierra Morena (Spain). Copper is obtained from the Sierra Morena, the Harz and Lower Rhine mountains of Germany, and in small quantities from the Urals, Norway, and the Ligurian Apennines. Zinc is important in Belgium and the adjoining parts of Prussia and the Netherlands, in Upper Silesia, the British Isles, France, and Spain. Spain and Germany are by far the most important European producers of lead, and are followed by Great Britain. The Georgian S.S.R. possesses the largest known deposits of manganese. The chief coal fields of Europe are the English, Scottish, Welsh, French-Belgian, Westphalian, Rhenish-Prussian, Saxon, Silesian, Bohemian, Polish —all except the Scottish lying in the Armorican-Variscan area— and those of the Oka and Donetz in Russia. Iron is found in most of these regions, and great deposits exist in the Sierra Morena and Cantabrian Mountains, around the central plateau of France, in the Scandinavian peninsula, and in Finland.

Where coal and iron occur together, and transportation facilities exist, great industries have sprung up. The chief industrial regions are the north of England, the lowlands of England, the Scottish lowlands, the northeast of France, Belgium, the Lower Rhine region, Westphalia, Saxony, Silesia, Bohemia, Poland, and the Donetz and Oka coal fields.

After the First World War. Not since 1815 had such drastic boundary changes been made in Europe. For the most part the new distribution of lands was motivated, in principle at least, not with the desire to despoil the vanquished nations but to liberate subject racial minorities and to repatriate national groups. Thus Germany lost territories, peopled chiefly by non-Germans, variously to France, Belgium, Poland, Czechoslovakia, and Denmark. From the disintegrated Austro-Hungarian empire emerged Austria and Hungary, as small States retaining only those territories peopled chiefly by their own nationals, while the regions inhabited by other nationalities went variously to Serbia, Roumania, Poland, Czechoslovakia, and Italy. The Serbs, Croats, and Slovenes formed the kingdom of Jugoslavia; the Rumanian-speaking people were united in a greater Rumania. The rest of the Balkan peninsula was divided among Greece, Albania, and a diminished Bulgaria. Russia lost all the territories on her western frontier peopled by foreign nationalities, variously to Poland, Rumania, and the new States of Finland, Estonia, Latvia, and Lithuania.

The hope cherished by many idealists that the peace treaties would establish the principle of national self-determination was, owing to the manifold difficulties involved, capable of only partial fulfillment. In the formation of boundaries, geographical, economic, and political factors inevitably played a part together with ethnic considerations. The union of Austria with Germany, which would have been in accord with the principle of self-determination, was explicitly forbidden in the peace treaties, and the long-agitated *Anschluss* was effected only in 1938. In the new republic of Czechoslovakia problems arose—especially under the influence of Nazi propaganda—over the German minority constituting nearly one-fourth of the population. After the absorption of Austria, the republic feared for her own independence. Almost one-third of the population of Poland is not Polish. In Jugoslavia the Croats began to rebel against the Serbs as soon as the kingdom was formed. The rise of the Nazis was followed by a brutal persecution of the Jews, not only in Germany but in other countries. These and other problems arising from racial minorities showed that, although certain obvious improvements had been made in the treatment of formerly subject peoples, Utopia had not been reached.

The dissolution of the Austro-Hungarian empire reduced the number of great European powers from six to five. Whereas before the war there had been one State, Spain, of moderate size, after it there were five—Spain, Poland, Rumania, Czechoslovakia, and Jugoslavia. The number of small States was increased from eleven to sixteen, and the total number from twenty (of which only three were republics) to twenty-seven. In Russia an attempt was made to solve the problem of racial and cultural minorities by the granting of cultural autonomy to regions of the Union of Soviet Socialist Republics. The language of each area was recognized as the official one and no attempt was made to Russianize the populace. Russia followed the American example of assimilation through toleration.

Religions.—The Greeks and the majority of the Slavs belong to the Greek Orthodox Church;

the rest of the Slavs, half the Celts, and the majority of the peoples speaking Romance languages, to the Roman Catholic Church; the rest of the Celts and most of the Teutonic peoples to various Protestant churches.

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History.—The history of Europe is in the main the history of the Indo-European or Aryan settlers on the Continent. We know little of their actual migration, but their starting-point seems to have been in Asia. Only four times has the ascendency of the Aryan race in Europe been at all seriously threatened. In the 3d century B.C. the Romans fought an all-important war against the Carthaginians, who were of Semitic origin. In the 5th century A.D., Attila, at the head of a vast Ural-Altaic horde, was checked by a great Aryan victory at Châlons (451). In the 8th century the conquering Moors were stopped by the victory of the Frankish leader, Charles Martel, at Tours (732). Finally, in the 15th century, when Europe was in the throes of a great transition, the Ottoman Turks captured Constantinople (1453), which had long been the bulwark of the Eastern Aryans, and threatened to advance up the Danube valley into the heart of Europe. This danger, however, was in the end averted; and though the Turks were not driven from European soil, and remain to this day the most important non-Aryan people on the Continent, their power has steadily declined during the last two centuries.

It is not till the 5th and 6th centuries B.C. that Europe begins to have a separate history of its own. The centre of early civilization was the E. Mediterranean. Leaving aside the Mycenæan civilization, the records of which are archæological rather than historical (*i.e.* documentary), the first inhabitants of Europe to enter into the arena of actual history were the Hellenes or Greeks. The Persians, pressing like all early conquerors towards the Mediterranean, found it necessary to conquer the Greek settlements on the coast of Asia Minor. The assistance which these Ionian Greeks received from the opposite peninsula, and especially from Athens, provoked the Persian rulers to attack the Greeks in Europe. The invaders were foiled in the famous battles of Marathon, Salamis, and Platæa (B.C. 479). These Persian wars gave a marvellous stimulus to the keen-witted Greeks, who within the next hundred years reached a stage in civilization far beyond that attained by any earlier people. Nor was the stimulus restricted to intellectual life. The great danger to which the Greeks had been exposed had clearly shown the evils of political disunion. The Greeks were united by language, by religion, and by common antipathy to the 'barbariars,' yet they did not constitute a nation. Their political unit was a city, or *polis*, and the chief cities were jealously hostile to each other. Athens, which had done more than any other state to resist the Persians, and whose people took the lead in the advance of literature and art, was rewarded with the headship of the confederacy of Delos, which seemed a momentous stride towards unity of action among the Greeks. But the tendency to isolation and division was thoroughly rooted both in the history of the race and in the geography of the land. Athens could lead, but she could not govern. Her ascendency was overthrown by Sparta in the Peloponnesian War (B.C. 431–404). Spartan domination, more brutal and more intolerable than that of Athens, was broken by the military successes of the Theban leader Epaminondas (B.C. 371–362). These divisions resulted in the enslavement of Greece to a neighboring and only semi-Greek state, Macedonia. Master of the forces of Greece as no native Greek had ever been, Alexander of Macedonia set out to conquer the Persians, and to make himself ruler of the known world. In a marvellous series of campaigns (B.C. 334–323), he carried the renown of Greek arms, and the more lasting influence of Greek civilization, over Egypt, the whole of S.W. and W. Asia, and even the northern provinces of India.

By the end of the 4th century B.C. Rome had already undergone a training for the task of foreign conquest and rule by the establishment of her supremacy over the Latins, Etruscans, Samnites, and other inhabitants of Central Italy. In the S. Rome found herself confronted by a number of Greek cities, and was thus brought for the first time into contact with the great civilizing force of E. Europe. Pyrrhus, king of Epirus, was tempted to aid the Greeks by the prospect of forming an empire in the W. which might rival that of Alexander in the E. But his intervention (B.C. 280–275) proved unsuccessful, and Rome became mistress of the whole of Italy as far as the N. ridge of the Apennines. The geographical position of Rome, and her immediate commercial needs, turned her attention rather to the W. Mediterranean than to the Levant, and hence arose the struggle with Carthage, a Phœnician colony which had made the N. coast of Africa a basis not only for commercial but also for political ascendency in the W. sea. The first Punic War (B.C. 264–241) made Rome a naval power—a necessary condition of extensive rule—and also gave her her first dependent province in the island of Sicily. In the second Punic War (B.C. 218–202) Hannibal, whose father had built up a great Carthaginian power in Spain, carried the war into Italy, and threatened the very foundations of Roman power. But in the end, in spite of his brilliant generalship, Hannibal failed. The war left Rome without a rival in the W., while it had also served to bring her into collision with Macedonia, which was still the dominant power of Greece. It is needless to trace the steps by which Rome was led from one annexation to another, until the whole of the Mediterranean coasts, including Greece, Syria, Egypt, and N. Africa, were brought under her rule. The extraordinary characteristic of these conquests was their durability. By the planting of colonies, by the extension of Roman citizenship, and by the extraordinary merits of their legal system, the Romans succeeded in assimilating their dominions as no earlier conquerors

had done. But this process of assimilation was not achieved all at once. For a long time the provinces suffered from the selfish exactions of Roman governors, while the wealth which flowed from them to the capital served both to corrupt political life and to widen the gap between the official oligarchy, who actually ruled the state, and the poorer classes, whose votes were to be bought by the highest bidder. Under the double difficulty of bitter class jealousies, which gave rise to civil wars, and of provincial discontent, the republican government broke down, and absolute authority was within the grasp of a successful soldier who could conciliate the support both of the army and of the mob. The founders of the empire were Julius Cæsar and his nephew Augustus. The forms and offices of the republic were carefully preserved, but all efficient control passed into the hands of the emperors.

With the fall of the republic the period of Roman expansion came to an end. On the N. and E. the frontier was still ill-defined and exposed to formidable opponents, the Germans and the Parthians. But a great disaster in A.D. 9, when three legions were cut to pieces by the German leader Arminius, induced Augustus to adopt a defensive instead of an aggressive policy, and to bequeath this counsel to his successors. The only notable exception was the establishment, in the reign of Claudius, of a Roman province in Britain, which was ultimately extended to the Clyde and the Forth. There can be no doubt that the condition of the provinces was enormously improved by the substitution of imperial for republican rule. Local officials were kept under far stricter control than had been possible before, prosperity increased under better government and comparative peace, and Roman citizenship was systematically extended, until its privileges came into the hands of all free subjects of Rome. But though the extremities might prosper for a time, there was an unhealthy and growing canker at the centre.

In spite of Rome's general success in welding her dominions into a coherent whole, there existed from the first a fundamental and a lasting distinction between the western and the eastern provinces. In the W. Rome had conquered barbarians, mostly Celts, whose civilization and intellectual development were inferior to her own. Upon these peoples Rome left a profound and ineffaceable impression. Gaul and Spain became as thoroughly Roman as Rome herself. They adopted the language, the habits, and the whole culture of their conquerors. But in the E. Rome found already established the superior civilization of Greece; and the Greeks, though politically subjugated, were intellectually victorious. In the often quoted words of Horace, 'Græcia capta ferum victorem cepit.' The Eastern world remained Greek after it had passed under Roman rule; and in course of time the empire, though founded in Rome, was drawn eastwards by the superior force and attractions of Greek influences. Constantine, who became sole emperor in 323, transferred his residence from Rome to the Greek city of Byzantium, which received from him its more familiar name of Constantinople. Another change of vital importance was due to Constantine, who abandoned paganism for Christianity, which henceforth tended to become the official religion of the empire. Christianity had originated in the province of Judæa, and had steadily thriven in spite of persecution. The dominant influence in its development had been Greek rather than Roman, and it is significant that its victory was coincident with the migration of the imperial court to the E. Another notable result of this migration was the weakening of the N.E. frontier, where the German tribes were becoming more and more restless and formidable. The expedient was adopted of taking some of them into the imperial service, but so obvious a confession of weakness could at the best only postpone the evil day. In the hope of strengthening Roman power in the W., a second emperor was set up in Rome, thus tacitly recognizing that severance between East and West which had been the one defect in Roman unity even when it was most complete. The N. frontier, long defended with ever-increasing difficulty, was finally broken through in the 4th century, and could never be restored. The German advance was impelled, not merely by greed of territory and plunder, but also by the aggressive movements of Asiatic tribes in the E. In 451 Attila led the Huns, one of these tribes, to attack both Germans and Romans in W. Europe. He was forced to evacuate Gaul after the battle of Châlons, and though he invaded Italy in the following year, he abstained from assaulting Rome, and his death soon afterwards put an end to all danger from the Huns. Their inroads, however, had served to hasten the inevitable end. Already, in 410, Alaric the Visigoth had taken and sacked Rome, and in 476 the nominal emperor of the West was deposed by the German conquerors, who were now the undisputed masters of W. Europe.

The final distribution of the German settlers upon Roman soil is perhaps more important than the history of their migration. The Vandals, one of the earliest and most destructive of the invading peoples, ultimately crossed into Africa, and made Carthage the centre of their power. The Visigoths, who at one time held Italy and Rome itself, left the peninsula to establish themselves in S. Gaul and Spain. The Burgundians settled in E. Gaul along the Upper Rhine and the valley of the Rhône. The Ostrogoths occupied Italy; Britain was divided among the Jutes, Angles, and Saxons; while the Franks, who, though late in coming, proved in the end the most prominent of all the Teutonic peoples, conquered N. Gaul and the greater part of W. Germany. From one point of view, these Teutonic conquests seemed to break the Roman empire to pieces, but the conquerors themselves never thought so. In every Roman province except Britain the invaders adopted the language, the religion, and in large measure the laws and institutions of the conquered inhabitants. The German leaders loved to assume titles of imperial grant, and so to claim some authority from the power which they were in reality engaged in overthrowing. When in 476 they deposed the emperor in Rome, they sent his insignia to the other emperor in Constantinople, as if they were merely putting an end to a needless schism, and restoring power to its lawful holder. This conception of the empire as still existing in spite of its actual disruption is all-important for a clear understanding of the middle ages, the period in which the German peoples set themselves to carry on the work of self-government which their success compelled them to undertake. During the reign of Justinian (527–565), the famous codifier of the Roman law, the authority of the emperor was once more restored in Africa and in Italy, though in the latter province it was before long shaken off again by the irruption of the Lombards.

This survival of the imperial idea had one very anomalous and unforeseen result. It was connected by tradition with Rome, which enjoyed the prestige of a capital, though it was no longer the home of Cæsar. The absence

of a secular monarch, combined with the past glories of the city enabled the bishop of Rome to advance pretensions which expressed the Roman conception of unity and of universal rule on the spiritual side. Pressed by the Lombards, and unable to obtain any assistance from the Eastern emperors, who were also discredited in Rome in the 8th century by their adoption of the iconoclastic heresy, the popes conceived the project of claiming the imperial dignity once more for a Western prince, though a fitting holder could be found only among the conquering Germans. In 800, the most powerful ruler in the West, the Frankish king Charles the Great, received the imperial crown from the hands of Pope Leo III. For a time the dignity remained in the hands of Charles's descendants, but after the disruption of the Carlovingian dominion it was ultimately united with the German kingship by the coronation of Otto the Great in 962. Thus the division between East and West, so long a fundamental fact in European history, was rendered permanent by both a secular and an ecclesiastical schism. Until 1453 a succession of Eastern princes claimed the titles and pretensions of the Cæsars in Constantinople, while a series of German kings advanced the same claims in the West, and sought to strengthen their claims by papal coronation in the ancient imperial city of Rome. And while supreme spiritual authority was wielded in Latin Christendom by the popes, the Greek Church, never so independent of state control, went on its way, and jealously maintained its own government, doctrine, and ritual.

Before this lasting separation of Eastern and Western Christendom had been completed by the coronation of Charles the Great, an event of immense importance both to the empire and the world had occurred in the East in the rise of Mohammed (570–632) and his militant church. From Africa the Mohammedans poured into Spain and Gaul, but their victorious career was checked at the battle of Tours (732); and though traces of their destructive activity may be found all along the N. coasts of the Mediterranean, their political domination in Europe, until the later incursions of the Ottoman Turks, was limited to the Spanish peninsula.

From the 9th to the 13th century W. Europe continued to be dominated by the Roman tradition of unity, represented by the dual headship of Pope and Emperor. The chief practical illustration of the unity of Latin Christendom was supplied by the crusades, a series of heroic efforts to wrest Palestine and the Holy Sepulchre from the hands of the Saracens. One important result of the crusades was to bring W. Europe into contact with the Eastern empire, and their most extraordinary episode was the diversion of the fourth crusade from its professed object in Asia to an attack upon the decadent Græco-Roman power, and the establishment for half a century (1204–61) of a Latin empire in Constantinople. The crusade ended in inevitable failure, which was finally completed by the fall of Acre, the last stronghold of the crusaders, in 1291. The famous Contest of Investitures was provoked in the 11th century by the advance of a claim for clerical autonomy. For a time the emperors were able to hold their own, but the popes controlled a more powerful administrative machinery, and wielded, in excommunication and interdict, the more formidable weapons. Moreover, the empire was strangled by its association with the German kingship, while in its turn the more lofty but shadowy dignity of the imperial office proved fatal to the monarchical authority within Germany. While the quarrels of the two nominal heads of Christendom were undermining their conjoint pretensions, separate states were growing up in the West whose local interests impelled them irresistibly to assert their independence of any external power. The dominions of Charles the Great had been divided among his descendants, and out of the confusing struggles and permutations there emerged two fairly coherent kingdoms, known at first as Western and Eastern Francia, but ultimately as France and Germany. Between these kingdoms lay a long strip of territory, called for a time Lotharingia, and later, in curtailed dimensions, the kingdom of Burgundy and Arles. These dominions were a bone of contention between the larger states on either side of them. For a time they seemed likely to belong to Germany, and the crown of Arles was assumed, as was that of Italy, by a series of Roman emperors and German kings. But in the end the bulk of them were absorbed by France. Farther W. the Christian peoples of Spain gradually took the aggressive against their Mohammedan conquerors, and, as the result of a long warfare, formed a number of separate states—Navarre, Aragon, Leon, Castile (Leon was absorbed by Castile in 1230) and Portugal. In the N. the Teutonic settlers in Britain, after prolonged struggles with one another, were formed into a single kingdom, England, under the headship of Wessex; and the unity of this kingdom was increased by two foreign conquests—the first by a Danish king, Cnut, the second by a duke of Normandy, William the Conqueror. By an extraordinary series of accidents, just at the time when England was achieving unity, the northern English between the Tweed and the Forth fell apart from their southern kinsmen, and combined with the Celtic population of the N. part of the island to form the separate kingdom of Scotland. The Scandinavians, another branch of the Teutonic race, after playing a great part as settlers and conquerors in Britain, in Normandy, and even in such distant regions as Naples and Sicily, gradually abandoned the aggressions to which their piratical and maritime habits had impelled them, and settled down to form three fairly well-defined states in Denmark, Norway, and Sweden. And another notable series of events in the N.E. belongs to this mediæval period. The latest of the Aryan immigrants into Europe, the Slavs, were heathens, and the zeal for conversion reinforced the desire for conquest. Two great families, the Welf dukes of Saxony and the Ascanian Margraves of Brandenburg, took the lead in asserting German ascendency along the Baltic coasts. Commercial interests were involved in the enterprise, which was carried on by the great association of German towns known as the Hanseatic League. Finally, one of the crusading orders the Teutonic Knights, having lost its occupation in Palestine, found a new scope for its energies among the heathen Wends, and extended both Christianity and German domination over the vast plains of Prussia.

The 14th and 15th centuries witnessed the great transition from the middle ages to modern times. The claims of the emperors had already ceased to be more than shadowy pretensions, for Charles IV. (1346–78) was the last to assume the crown of Arles. The kingship of Italy gave no real power, and the shrewder emperors were willing to let it go; even within Germany the authority of the emperors never recovered from the shock given to it by the Great Interregnum (1254–73), when two foreign princes claimed the title without attempting to exercise any of the functions of the office. The more firmly grounded power of the papacy did not long survive the decline of its rival.

Europe

Residence in Avignon for nearly seventy years (1309–77) degraded the popes almost to the level of French bishops, and aroused against them all the antagonism which was felt by neighboring nations towards France. No sooner had the papal residence been restored to Rome than the Great Schism (1378–1418) gave rise to what seemed at the time an almost irresistible demand for ecclesiastical reform. And though the papacy succeeded in weathering the storms raised in the Councils of Constance (1414–18) and of Basel (1431–49), it was only to excite greater antipathy and disgust by its absorption in the secular task of building up its temporal dominion in central Italy. France, forced by the Hundred Years' War into unity with England, received administrative order under a powerful monarchy from Charles VII. and Louis XI. In England the anarchy of the Wars of the Roses worked its own cure by leading to the annihilation of the old nobles and the concentration of political power in the hands of the Tudor dynasty. The Scandinavian kingdoms were combined for a time by the union of Kalmar (1397), though mutual jealousy and German hostility prevented the union from being either complete or permanent. In the Spanish peninsula the triumph of the Christians was completed by the conquest of Granada (1492), and in the same generation the foundation of a powerful Spanish kingdom was laid by the dynastic union of Castile and Aragon (1479), and by the annexation in 1512–15 of the greater part of Navarre.

The Reformation of the 16th century harmonized with the political conditions of the age. So far as Protestantism prevailed, it prevailed by its alliance with national forces and aspirations. Only in the two states which had been most closely associated with imperial tradition was the dominant tendency to monarchical centralization impotent. Italy remained, as it long had been, a mere bundle of states, and became the battle-ground on which the rival nations fought out their quarrels. In Germany all prospect of monarchical revival or national union seemed to be at an end when the Reformation added religious disruption to the previous political causes of division and strife. The weakness which Germany owed to its want of unity was rendered conspicuous in the 15th century, not only by losses to France on its W. border, but also by the turn of the tide in favor of the Slavs in the struggle in Bohemia and Poland. The Hussite War, in which German armies suffered such humiliating disasters (1420–31), was no mere religious struggle; it was more important as a revolt of the Slavs of Bohemia against German domination. Still more serious were the disasters of the Teutonic Order. The accession of the house of Jagello in Poland (1386) not only united the Poles with the Lithuanians, but also took away the religious character of the war by establishing Christianity among the combined Slavs. From this time the fortune of the war went against the Knights, who were compelled by the Treaty of Thorn (1466) to hand over the greater part of Prussia to Poland, and to hold the small E. district which was left to them under Polish suzerainty. In the S.E. an even greater danger presented itself. The fall of Constantinople (1453) removed the great barrier which had long impeded the advance of the Ottoman Turks, and Greece and the Balkan provinces fell into their hands. The possession of the Levant by the Mohammedan conquerors, completed by the seizure of Egypt in 1517, closed the old trade-routes between Europe and the East, and impelled the Spaniards and Portuguese to undertake those famous voyages which resulted in the discovery of a way to India round the Cape and of the American continent. Meanwhile the Turks continued their aggressions in Europe, but fortunately the Slavs and the Magyars were induced to join in championing the Cross against the Crescent, and the repulse of Sultan Suleiman from Vienna in 1529 marks the limit of Ottoman advance towards the W.

The final emergence in the 16th century of the great European nations resulted in the rise of a regular system of diplomacy and of orderly international relations. For a long time these relations were mainly determined partly by the religious divisions created by the Reformation, and by the resultant revival of Roman Catholicism, which is called the counter-reformation, and partly by the principle, adopted from the little states of Italy, of the balance of power. The marked aggrandizement of any state was certain, sooner or later, to provoke a hostile combination among the other states whose independence was thus threatened. In the 16th century an extraordinary series of fortunate marriages and consequent inheritances gave to a Hapsburg prince, the Emperor Charles V., an agglomeration of territories in Spain, Italy, the Netherlands, Germany, and the New World, which made him more powerful than any Western ruler had been since Charles the Great. On his abdication in 1555, the German provinces with the imperial dignity passed to a separate branch of the Hapsburg family; but his son, Philip II., who received Spain with its colonies, the Italian provinces, and the Low Countries, seemed to be quite as formidable as his father when, in 1580, he acquired Portugal and the vast mercantile and colonial power which Portuguese enterprise had built up. It was enormously in his favor that religious wars crippled the power of France, which had successfully opposed his father, and that he was able to stir up both religious and dynastic hostility against the English queen, Elizabeth. Yet, in spite of these advantages, the predominance of Spain proved very short-lived. It was weakened in the centre by want of administrative unity and order and by a faulty economic system. A revolt in the Netherlands led to the establishment of an independent Dutch republic, which rapidly became a formidable military and naval power. Elizabeth disarmed her domestic opponents by the execution of Mary Queen of Scots, while English seamen not only repulsed the Spanish Armada, but struck in distant seas at the vital sources of Spanish strength. Finally, the accession of the Bourbon dynasty in France put an end to civil strife; and under the guidance of a great king, Henry IV., and a greater minister, Cardinal Richelieu, France broke through the barriers with which the Hapsburg power had sought to shut her in on every side. Portugal, encouraged and aided by France, recovered her independence (1640–68), and by the treaty of the Pyrenees (1659) Spain was reduced to the rank of a second-rate power.

The victory over Spain made France as formidable as its rival had ever been. Richelieu and Mazarin bequeathed to Louis XIV. a power in Europe which he sought to erect into supremacy One aggressive war followed another, and in each France extended her frontier. Even in time of peace annexations were made. Spain, Holland, Austria, and the German princes tried in vain to resist these encroachments, but the military power of France seemed to be more than a match for the ill-concerted efforts of a coalition. And a vast danger loomed in the future. The male line of the Hapsburgs was on the verge of extinction, and the nearest heiress was the wife of the French king. It is true that she had renounced her claim at the time of her mar-

riage, but the validity of the renunciation had already been denied by France, and such an obstacle was not likely to obstruct the ambition of Louis XIV. If France, already so irresistible, could acquire control of the still vast dominions of Spain, her omnipotence would be assured.

Fortunately for Europe, a notable event in English history came at the right moment to strengthen the antagonism toward France. The restored Stuart kings, Charles II. and James II., had allowed themselves to become pensionaries of Louis XIV., who thus secured the aid, or at any rate the neutrality, of England. But the revolution of 1688–9, provoked by the religious attitude of James II., transferred the English crown to William III., who was already recognized as the leader of European resistance to French aggression.

In 1700 the Spanish succession became vacant, and was secured by a grandson of Louis XIV., Philip V. The Grand Alliance, with England, Holland, and Austria as its chief members, was formed to oppose such a vast aggrandizement of the house of Bourbon. A series of brilliant victories on the part of the allies broke the power of France. Philip V. was allowed to keep Spain and the colonies, but the outlying Spanish dominions in Europe were mostly transferred to the Austrian Hapsburgs, and the strengthening of England, now united with Scotland, combined with the exhaustion and semi-bankruptcy of France, marked the failure of the ambitious schemes of Louis XIV.

The Treaties of Utrecht (1713) and Rastadt (1714), which closed the War of the Spanish Succession, seemed to establish that desired equilibrium in Europe which had been twice endangered, first by Spain and then by France. Yet from 1714 to 1789 the European states were always either at war or on the verge of war with one another. This was due to three great disturbing forces—(1) the rivalry of France and Great Britain for maritime and colonial ascendency; (2) the rise to sudden pre-eminence of a new power, Russia; (3) the desire of Frederick the Great to remedy Prussia's geographical weakness.

(1) The colonial duel was rendered inevitable by the decline of earlier rivals in the field—Portugal, Spain, and Holland—and it ended in the discomfiture of France. Owing to superior finance, superior naval power, and the distraction of French resources by the struggles on the Continent, Great Britain was able, in the Seven Years' War (1756–63), to deprive the French of Canada and Louisiana, to weaken both French and Spanish power in the West Indies, and to wrest all political and military authority from the East India Company of France. The revolt of the American colonies (1775–83) enabled France and Spain to resume the struggle under more advantageous conditions; but Rodney's victory in 1782 maintained the sorely threatened naval preponderance of England; and though the colonies secured their independence, their Continental allies gained little by the war.

(2) The rise of Russia is the greatest event of the period, from an international point of view. While Southern Europe had been absorbed for two centuries in resisting first Hapsburg and then Bourbon ascendency, the northern states had a separate thread of history. This was woven round the struggle for supremacy in the Baltic (*dominium maris Baltici*), which had been left vacant by the decline of the Hanseatic League. The prize fell first to Sweden, and was well earned by the victories of Gustavus Adolphus and Charles X. On the north, east, and south of the Baltic, Swedish preponderance seemed stronger than ever when Charles XII. crushed the hostile coalition of Denmark, Poland, and Russia. But Charles' invasion of Russia and the defeat of Poltava (1709) ruined the power of Sweden, as a similar enterprise a century later ruined the power of Napoleon. Peter the Great seized the Swedish provinces to the east of the Baltic, built there a new capital, St. Petersburg, and set himself to introduce Western civilization into Russia. From this time Russia became more and more prominent in the politics of Europe, until under Catherine I. (1762–96) she swept away the intermediate Slav state of Poland, reached southward to the Black Sea, and on occasion dictated her will to the Western powers.

(3) The state of Prussia was built up under the house of Hohenzollern by the union of the old marks or border provinces of Brandenburg, wrested in bygone ages from the Slavs, with Eastern Prussia, the remnant of the once extensive dominions of the Teutonic Order, and with a portion of the inheritance of the dukes of Cleve. Thus the imperative necessity of strengthening a kingdom which had no natural unity explains, if it does not excuse, Frederick the Great's seizure of Silesia, and also his unscrupulous conduct in the first partition of Poland (1772), which gave him the invaluable province of Western Prussia.

The French Revolution marks a great epoch in the history of Europe. It destroyed the secular and the clerical aristocracy of France; it destroyed, though less completely, the French monarchy; but it did not destroy—on the contrary, it rather strengthened—the unity and centralization which had been the secret of French strength. This became apparent when, in 1792, war began between the republic and the chief powers of Europe. To the astonishment of the world, France, which was thought to be ruined, displayed under both republic and empire a military vigor even greater than that which had defied Europe in the time of Louis XIV. One coalition after another was crushed, and every Continental state, except Russia, suffered humiliation

When in 1807 Russia agreed, by the Treaty of Tilsit, to become the accomplice of imperial France, Great Britain seemed to be the only hindrance to French domination in Europe. Napoleon had long perceived both the difficulty and the necessity of humbling 'perfidious Albion.' He had invaded Egypt and threatened India, but his Oriental schemes had been foiled by Nelson's victory at the Nile (1798). He had induced the northern powers to form the Armed Neutrality in 1800, in order to resist the maritime ascendency of England; but the league had been dissolved by the bombardment of Copenhagen and by the death (1801) of the Russian Czar, Paul I. In 1804 he planned a direct invasion of English soil, but the enterprise had to be abandoned on account of (1) the failure of Villeneuve to effect the desired naval concentration in the Channel, and (2) the arming of Austria and Russia in the east. The battle of Trafalgar (1805), by annihilating the naval forces at the disposal of France, left Napoleon no means of striking his enemy except by destroying her commerce.

By the Decrees of Berlin (1806) and Milan (1807) he deliberately set himself to close the markets of Europe to British trade. It was a fatal enterprise. He could only ruin Britain by ruining Europe at the same time, and the dependent allies and subjects of France refused to pay such a price for the triumph of a selfish despot. Disaffection had to be put down by force, and Napo-

Europe

leon discovered that in order to carry out his 'Continental system,' he must conquer Europe; that he must crush Portugal, Spain, and Russia as he had already crushed Italy and Germany. He did not shrink from the task, but it was beyond his strength. The Peninsular War, the disastrous march to Moscow, and the revolt of Germany in 1813, broke the power of imperial France, and after the brief scare of the 'Hundred Days' had ended at Waterloo, the successful allies reconstructed the map of Europe at the Congress of Vienna.

Since the first of the nineteenth century, two threads may be traced through the tangled skein of European diplomacy. One of these is the growth of the sentiment of nationality, strengthened by the French Revolution, though disregarded by the framers of the Treaty of Vienna. A successful revolt, encouraged by Russia and by Western sympathy, enabled Greece in 1829 to throw off the rule of the Turks, and to found an independent kingdom. Belgium, united with Holland in 1815 to form a kingdom of the Netherlands, rebelled against Dutch rule in 1830, and became a separate State under a king of its own. The Magyars of Hungary, long restless and discontented under Austrian rule, were crushed by Russian intervention after an uprising in 1848; but in spite of their defeat they succeeded in obtaining a constitution in 1867 which gave them, under the 'dual monarchy,' a substantial measure of self-government. Italy expelled the foreign rulers from its soil, and formed a united kingdom under the house of Savoy (1861). Nine years later, aided by German victories over France, Italy completed its external unity by extinguishing the temporal dominion of the popes and by establishing its capital in Rome (1870).

In Germany, the national sentiment kindled by the long Napoleonic struggle had been woefully disappointed in 1815. The Bund, created by the Congress of Vienna, was a most feeble and futile federation, all projects of reform being defeated by the action of Austria. At last Prussia, under the guidance of Bismarck, picked a quarrel with Austria about the duchies of Schleswig and Holstein; won a complete victory in the Seven Weeks' War (1866); and utilized its success to organize the North German Confederation (q. v.) in 1867. An opportune dispute with France, followed by a victorious march to Paris (see Franco-German War), made it possible for Prussia to win over the South German States, and to found the German empire.

European history following the Treaty of Vienna was, to a great extent, supplied by the Eastern Question (q. v.), which arose from the persistent efforts of Russia to reach the Mediterranean. The most efficient weapon in the hands of Russia was her claim to champion the cause of the Christian subjects of Turkey, which was recognized in 1774 by the Treaty of Kutchuk-Kainardji. The Turks were no match for Russia, and their decline was marked by the concessions of independence, wholly or in part, first to Greece and Egypt, and later to a number of principalities in the Balkan peninsula—Serbia, Roumania, Bulgaria. But the Ottoman power was saved from extinction partly by the jealous diplomacy of Austria, and partly by the action of Great Britain, whose interests in India made her view Russian advance with suspicion. Twice during the nineteenth century was the Russian advance in Southern Europe openly opposed—once by England and France in the Crimean War (q. v.), in 1854–6, and again at the Congress of Berlin (q. v.), in 1878, when Russia had to moderate the terms imposed upon Turkey after a successful war.

The close of the nineteenth century found the chief Continental powers in two well-defined groups. On one side was the Triple Alliance (1883) of Germany, Austria, and Italy; on the other, the Dual Alliance (1895) of France and Russia. Great Britain, according to her traditional policy, held aloof from Continental obligations.

1900–1915.—During the opening years of the new century, important factors in European history were (1) the movement toward popular government, (2) the religious unrest in the southern countries, and (3) the new balance of power, and the disturbance of European interests in other continents.

(1) The movement toward popular government was evinced by the formation of a constitutional kingdom in Norway after its separation from Sweden (1905); the summoning of the Russian duma (1906); the victorious revolution of the constitutional party in Turkey (1908); the establishment of a republic in Portugal (1910); the granting of local autonomy to Alsace-Lorraine (1911); the curtailing of the power of the British House of Lords (1911); the revision of the Greek constitution, providing for the better working of liberal institutions (1911); and the passage of the Irish Home Rule Bill (see Home Rule) in the British Parliament (1914).

Throughout Europe there developed a labor unrest unparalleled since 1848; and the various countries, especially Germany and Great Britain, in their attempts to grapple with the problem, made progress toward State socialism in legislation providing for old-age pensions, sickness and unemployment insurance, housing, etc.

(2) In the south of Europe, a general agitation, largely political and economic, for the separation of church and State resulted in disestablishment in France (1905) and in Portugal (1910). In Spain appeared a strong anti-clerical party; and the disestablishment of the Church of England was widely agitated, resulting in Welsh disestablishment in 1914. (See Disestablishment).

(3) New elements in the balance of power were the increased strength of Germany and Austria, and the union of England, France, and Russia in a Triple Entente. Belgium and Holland, fearful of German-Austrian aggression, strengthened their defenses; and Holland entered into treaty relations with Great Britain. The latter's supremacy on the sea continued to be threatened by extension of the German and Austrian navies. This naval rivalry was recognized as placing the greatest strain upon international relations, and the grouping of the Powers into the Triple Entente and the Triple Alliance was held by rulers and statesmen to be the best possible means of maintaining equilibrium and peace. The Triple Alliance was ruptured, however, when Italy, claiming that the bond was for defense only, refused to enter the World War (see Europe, Great War of) on the side of the Teutonic Allies, and in May, 1915, joined the Entente.

The encroachments of Christian Europe upon the Mohammedan world were responsible for marked geographical changes in the maps of Europe and Africa, and seemed to indicate that the Ottoman Empire was reaching its end. The Greco-Turkish War of 1897 (see Greece) resulted in only slight frontier modifications; but in 1908, Crete announced its allegiance to Greece, Bulgaria declared her complete independence of the Porte, and Bosnia and Herzegovina were annexed by Austria-Hungary. Turkey refused to acknowledge the alienation of Crete; but she ratified Bulgaria's act when Russia agreed to advance some $15,000,000 of the demanded indemnity; and she was content to let Bosnia and

Europe

Herzegovina go upon the payment by Austria of $12,500,000.

Italy regarded Tripoli as her share of the inevitable division of the Porte's dominions; and fearing Germany's intrusion upon her claims, she found a pretext and declared war on Turkey on Sept. 29, 1911. In the ensuing settlement (the Peace of Ouchy, 1912), Italy was awarded Libya (Tripolitania and Cyrenaica in Africa).

The Balkan Wars of 1912 and 1913 (see BALKAN WAR) ended in the partition of European Turkey, except 11,000 square miles, among Serbia, Bulgaria and Greece; the creation of the independent State of Albania (q. v.); and the establishment of Slavic supremacy in the Balkan Peninsula, under the protection of Russia. The threatened exercise of this protection was the immediate cause of the quarrel between Austria and Serbia in 1914 blazing into the general European War.

In Western Asia, Russia, after her recovery from her war with Japan (see RUSSO-JAPANESE WAR), began to resist Turkey's hand in Persia. An Anglo-Russian agreement in 1907 delimited the Persian sphere of influence of both powers to the southern and northern provinces respectively. An understanding between Germany and Russia (Potsdam, November, 1910) was followed by an agreement (1911) defining exactly the spheres and conditions under which they were to exercise control over railway building in Persia.

Morocco continued to be a source of international friction. The Treaty of Algeciras (1906) and the Franco-German agreement of 1909 left the police power in Morocco to France and Spain. While the two countries disclaimed any intention of territorial acquisition, Germany adopted an aggressive policy, nominally for the protection of German citizens and property. This culminated in the Agadir Incident (see MOROCCO) of July, 1911, which was settled by Germany's recognizing French supremacy in Morocco, and receiving as 'compensation' a large slice of the French Congo, which reverted to France after the World War.

Japan, by her naval equipment and the prestige gained by her victories over China and Russia, was admitted to equality with the European Powers in the settlement of Eastern affairs. Japan and Russia came to an agreement concerning Manchuria in 1911; and in the same year Japan and England renewed, with modifications, their alliance of 1902.

In the West, also, international relations ceased to be wholly European. The United States, which in 1898 deprived Spain of most of her remaining colonial power, had acquired considerable influence in European diplomacy even before her part in the World War. See UNITED STATES.

1915–19.—The history of Europe from the middle of 1914 to 1918 was the history of the World War, which was precipitated by the assassination on June 28, 1914, of the Archduke Francis Ferdinand (q. v.), heir presumptive to the thrones of Austria and Hungary. The principal causes of the war were the alliances among the powers, which bred mutual suspicion, the existence of huge armaments, the growing spirit of nationalism, and a desire for empire. For a record of this tremendous conflict, see EUROPE, GREAT WAR OF.

The Peace Conference, which assembled in Paris on Jan. 18, 1919, was confronted with problems of vast significance for the future not only of Europe but of the world. When the peace treaty neared completion, Germany's delegates were invited to Versailles to receive the Allies' terms. The historic document was signed in the great Palace of Versailles on June 28. A peace treaty with Austria was signed in St. Germain, near Paris, on September 10; the Treaty of Neuilly with Bulgaria was signed November 27; the treaty with Hungary was signed in the Grand Trianon June 4, 1920; and the definitive peace treaty with Turkey was signed in Lausanne July 23, 1923. The United States, which did not ratify these treaties, concluded independent treaties with Germany, Austria, and Hungary, which omitted the League Covenant. (See PEACE CONFERENCE; LEAGUE OF NATIONS; UNITED STATES: *History*).

After the World War.—The war had dealt a shattering blow to the countries of Europe, not only to the vanquished but also to the so-called victors. For decades to come, the sad loss of manpower was to be felt in the lives of the nations. Despite the prevalent conception that Germany and her allies were responsible for the war and should be made to pay for the damage it had entailed, the attempt to exact reparation achieved little practical success. Poverty and starvation were the lot of the defeated countries. Millions of people and lands rich in natural resources had been taken from them, to be set up in separate national groups. Chaotic political conditions aggravated the distress of industrial life. Currencies, inflated to support the war which had been expected to bring victory and acquisitions, at last collapsed. In numerous cases help was furnished by recent enemies, prompted both by humanitarian sentiments and self-interest. But in the Allied countries too the economic effects of the war were found in successive disturbances. In those regions which had served as the actual theatre of hostilities, a great and expensive program of reconstruction was necessary.

Out of the horror of the war had crystallized a fervent hope —that another such catastrophe be prevented. Many persons feared that the very terms of peace contained the seeds of future wars. But although Wilson's earlier hope of a 'peace without victory' had been repudiated, the final settlement was not dictated solely by statesmen of the old, 'practical,' Machiavellian school. Though there were exceptions, the shifting of peoples from one State to another was in the main dictated by considerations of nationality. In some cases the will of the people concerned was ascertained by plebiscites. Generally, where it was necessary or expedient for strategic or geographical or economic reasons to include an alien people in a nation, an attempt was made to protect their political, religious, and linguistic rights by minority treaties under the aegis of the League of Nations. Again, though the victors' desire for spoils cost Germany her colonies and Turkey much of her territory, those regions were to be held as mandates, concerning which regular reports were to be made to the world.

On the other hand, however, the hope for peace was expressed in the provisions looking towards the suppression of Germany. Out of similar fear in 1814 the Vienna settlement had been aimed at the protection of Europe against France. The expectation of keeping such a nation as Germany, with more than sixty million people, in a condition of lasting inferiority, was of course, and as many observers realized from the first, doomed to disappointment. The very pertinacity of the attempt to do so contributed finally to the resurgence of nationalism in Germany which made possible Hitler's accession to power in 1933. By the end of the 1920's France had achieved a virtual hegemony on the continent; a few years later, when the *Führer* destroyed provision after provision of the Versailles Treaty in a blaze of national glory, that leadership was sadly battered. France, the network of allies she had assiduously cultivated, even, indeed, cautious England, real-

Europe

ized that they had to cope with a present threat instead of a latent fear. By that time new alignments were in order; the smaller nations took fresh stock of the strength of rival large nations, with a hind glance at their small-fry neighbors, while the major powers adopted a 'realistic' attitude toward the exercise of force in the pursuit of imperial domination (as in the conquest of Ethiopia and the absorption of Austria) and the potentialities of force. The gropings toward a pan-Europa, such as the 1920's had seen in the form of the ascendant League of Nations, Locarno, the Pact of Paris, disarmament conferences, and, in 1930, talk of a United States of Europe, were, at least for the time being, forgotten. The old game of power diplomacy was being played again, with Germany temporarily naming the stakes.

League of Nations.—In the League of Nations (q. v.) idealists hoped that an instrumentality had been created which would prevent another recourse to armed combat as a means of settling international disputes. Although the League had no military machinery at its disposal to enforce its policies and decisions, it was believed that a refractory nation would not regard lightly the moral censure of a world confederation. In Article XVI, moreover, an economic 'weapon' was envisioned by which, it was believed, a nation resorting to war in defiance of its obligations under the League could be isolated economically.

The refusal of the United States to enter the League was regarded as a major loss to the cause of peace and international co-operation. Beginning in 1922, however, the United States sent 'unofficial observers' to conferences sponsored by the League, and in succeeding years co-operated more fully, frequently adding her weight to, or helping to formulate, League policies.

During the first decade of its existence the League, which had been called into being chiefly for the maintenance of world peace, was employed as an agency to put into effect numerous features of the peace settlement, and to compose international disagreements arising from post-war adjustments. The League's success was not always uniform or unequivocal, even in its dealings with the smaller nations. Among its earliest accomplishments were: the award of the Åland Islands (q. v.), claimed by both Finland and Sweden, to the former; an agreement between Poland and Germany concerning the boundary line through Upper Silesia (q. v.); averting a Balkan war imminent after Jugoslavia had invaded Albania (q. v.) in 1921, by threatening to consider the application of economic sanctions, under Article XVI, against Jugoslavia; mediation resulting in a treaty between Great Britain and Turkey concerning the disputed boundary of Mosul; securing the evacuation of Corfu (q. v.), seized by Italy in reprisal against Greece; ending hostilities between Greece and Bulgaria over a border incident in 1925; notable financial aid to Austria, Hungary, Greece, Bulgaria, Estonia, and the Free City of Danzig (qq. v.). On the other hand the conflict between Lithuania and Poland over Vilna (q. v.) was decided by force, rather than the League's intercession, when the Polish irregular, General Żeligowski, occupied the city in 1920. The Lithuanians continued to claim Vilna, their historic capital. The Lithuanians, however, in 1923 forcibly took possession of Memel (q. v.), and this time Poland protested ineffectually.

The League was also unsuccessful in the Bolivian-Paraguayan dispute in the Chaco. In 1933 Paraguay, still a member of the League, even went so far as to make a formal declaration of war. An arms embargo was approved by twenty-eight nations, but evasions weakened its effect.

Japan vs. the League.—A greater blow to the League's prestige was delivered by Japan. Following the invasion of Manchuria in 1931, China appealed to the League. Japan, however, paid no attention to the League's orders that she withdraw. In February, 1933, the League, adopting the Lytton report, again ordered Japan to withdraw from Manchuria. Japan instead withdrew from the League. Not content with setting up the puppet State of Manchukuo, Japan extended her operations southward, and the incident of July 7, 1937, was followed by the long-expected major war against China proper.

Italy vs. the League.—The League proved equally impotent to prevent Italy's conquest of Ethiopia. In this instance a crucial test was made as to whether the nations through collective action, but without resort to military measures, could protect a weak country against the aggression of a strong power. Admirers of the League believed that the high-water mark of that body's career to date was reached in October, 1935, when economic sanctions were put in motion against Italy. Nevertheless Great Britain, the chief proponent of sanctions, was perhaps more concerned with the jeopardy of her own imperial interests and trade routes than by an idealistic regard for League forms or a solicitude for the country of Haile Selassie. By the beginning of 1936 the effect of sanctions was seriously felt in Italy. The sanctionist policy, however, was defeated by three major factors: Italy's trade with non-sanctionist countries continued either in customary or increased volume; a projected embargo on petroleum, which Mussolini had said he would consider an act involving war, was postponed and finally shelved; Italy's military campaign was brought to a successful conclusion much sooner than had been expected. In the face of a *fait accompli*, the formal annexation of Ethiopia, idealism gave way to realism and 'common sense': the sanctions against Italy were suspended July 15, 1936.

Disarmament and Rearmament.—Many peace-lovers believed that the outbreak of hostilities in 1914 had refuted the idea that large armaments serve as a guarantee of peace. The statesmen at the Paris Peace Conference, consequently, looked towards the 'reduction of national armaments to the lowest point consistent with national safety.' The restrictions made on her military and naval strength, the Allies assured Germany, 'were not made solely with the object of rendering it impossible for Germany to resume her policy of military aggression,' but were rather 'the first steps towards that general reduction and limitation of armaments which they seek to bring about as one of the most fruitful preventives of war.'

Naval Limitation.—While the cause of disarmament achieved some success with regard to navies, it made no headway in respect to armies. At the Washington naval conference, Nov. 12, 1921–Feb. 6, 1922 (see UNITED STATES: *History*), the future tonnage of capital ships was fixed at a ratio of 5:5:3 for Great Britain, the United States, and Japan, and 1.67 for France and Italy; a ten-year holiday in the construction of capital ships was declared; and it was provided that many ships already built or being constructed were to be scrapped.

In 1927 at the invitation of President Coolidge a conference met in Geneva to consider the limitation of cruisers, destroyers, and submarines. Great Britain, the United States, and Japan were represented; France and Italy had declined to attend. Since no compromise could be reached between the British desire for a large number of small cruisers and the American pro-

Europe

gram of a small number of large cruisers, the conference failed.

Following the visit of Premier MacDonald to President Hoover in 1929 the British government instituted a five-power naval conference in London, which opened Jan. 21, 1930 (see NAVAL DISARMAMENT). On this occasion the existing holiday in capital ships was extended for five years, that is, until the end of 1936. The dispute over cruisers was solved by allowing a greater number of small cruisers to Great Britain and a greater number of larger cruisers to the United States. While the United States was granted parity with Britain, it would have cost the United States a billion dollars by 1936 had she wished actually to equal British tonnage. Differences arose between Italy and France when the former demanded parity with the latter in all categories, while France insisted that parity would give Italy actual superiority in the Mediterranean, since France had two seas to defend. The world depression, however, prevented Italy from entering a naval competition with the purpose of challenging France's actual superiority.

Mutual Assistance.—The League Council appointed a commission in February, 1921, to prepare suggestions for the reduction of armaments. Having decided that such a reduction must be compensated for by some form of mutual security, the commission drew up a Treaty of Mutual Assistance, which was unanimously adopted by the Fourth Assembly of the League in September, 1923. The security envisioned by this draft treaty lay in the assurance given by the signatory powers that they would come to the assistance of any signatory nation in the event of its being attacked. Which State was the aggressor, in case of war, was to be determined by the Council. The Council was also to prepare a general scheme of arms reduction for the signatory States. This draft treaty, circulated among all the nations of the world, failed of acceptance. It was approved in general by those countries, such as France and the succession States, which needed immediate guarantees of security; it was opposed in general by those nations farther removed from danger and reluctant to increase their international obligations, such as the United States, Great Britain, Russia, and Germany.

A new element, arbitration, was provided for by the 'Geneva Protocol,' which was unanimously approved by the League Assembly on Oct. 2, 1924. This provided that all legal disputes must go before the World Court and all nonlegal controversies be submitted to arbitration. Any State resorting to war—which was declared a criminal offense—in violation of provisions of the Covenant or the protocol, became an aggressor and liable to economic boycott under Article XVI. The Geneva protocol, however, met much the same fate as the earlier treaty of mutual assistance.

Geneva Disarmament Conference.—After the League's preparatory commission, beginning in May, 1926, had paved the way for it, the world's first general disarmament conference (see NAVAL DISARMAMENT) convened in Geneva on Feb. 2, 1932, with sixty nations represented. The meetings soon proved to be rich in proposals but poor in agreements. France, interested in strengthening the instruments of collective security, early proposed that an international force, chiefly aircraft, should be created and placed at the League's disposal for use in the application of sanctions under Article XVI of the Covenant. This suggestion won little support except from France's allies. Germany, on the other hand, was primarily concerned with gaining recognition of her 'equality of right' to equal armaments with other countries. Soviet Russia, preoccupied with her internal development and glad to be left at peace for many years to come, proposed a progressive reduction of armaments with a view towards their complete abolition. A deadlock ensued, which President Hoover of the United States sought to break by suggesting the reduction of 'defense' armaments by one-third. At its adjournment in July, Germany gave notice that she would not return to the conference until her demand for equality had been granted.

In December the principal powers reached agreement on a plan offered by Premier Herriot of France which aimed at reconciling the French insistence on security with Germany's desire for equality, and the latter nation agreed to return to the conference. Nevertheless, soon after the new session began on Feb. 2, 1933, Germany raised unexpected objections to the French plan, with a view towards revision of the peace treaties. The conference was again saved from immediate collapse, this time by British Premier MacDonald, who offered concrete suggestions for the reduction of armies and armaments. Germany now proposed a larger increase of her military strength than she had requested before, and indicated that regardless of the outcome of the conference, she would rearm. The Reichstag was summoned to meet on May 17 to hear a statement on foreign policy by Chancellor Hitler.

It was generally feared that Hitler was going to announce the immediate rearmament of Germany. Nevertheless, after President Roosevelt had appealed to the governments of the world on the previous day to adopt the British disarmament plan and conclude a nonaggression pact (see UNITED STATES: *History*), Hitler proved more conciliatory than expected. Germany, he said, was willing to abolish her whole military establishment at once, if her neighbors would do likewise. More to the point, he said that Germany was willing to agree to a transitional period of five years before reaching equality with other nations—but would not accede to any attempt to perpetuate her disqualification.

On Oct. 14, 1933, Germany startled the world by announcing her withdrawal from the disarmament conference and her intention to quit the League of Nations. The reason given by her foreign minister was that Germany's claim to equality, which had been the condition of her return to the conference in December, 1922, would apparently not be satisfied. In the next few months attempts were made, unavailingly, to reconcile conflicting French and German views on the conditions of Germany's rearming.

The disarmament conference, after a last brief session, finally adjourned June 11, 1934. The major disagreement had been over the contention of the British, American, Italian and other delegates that disarmament should be considered first, and defensive security be viewed as resulting from it; while the French and Russian delegates placed security first and disarmament second.

Germany Rearms.—Early in 1935 Great Britain and France made overtures to Germany with a view to abolition of Part V of the Treaty of Versailles, limiting Germany's armaments, conditional on Germany's return to the League and signing of pacts of mutual assistance with countries of central and eastern Europe. But Germany proceeded by herself; on March 16 Hitler announced that in spite of the Versailles treaty Germany would immediately reintroduce compulsory military service and would increase the peace size of her army to about 550,000 men. Hitler argued that the Versailles treaty had already been nullified by the Allies, who had failed to carry out their promise of gen-

Europe

eral disarmament. He justified the step further by pointing to Soviet Russia's huge army and France's restoration of two-year military service, and declaring that Germany must take measures for her own national defense.

Great Britain, France, and Italy at once filed protests in Berlin. On April 11 representatives of these states met in Stresa and formed what appeared to be a united front against Germany's rearmament program. On May 22 Hitler declared that Germany was willing to enter into agreements on the limitation and restriction of armaments, pointed out that Germany had repudiated only the military clauses of the Versailles Treaty, and solemnly promised to respect all other features of the treaty, including the territorial provisions and the demilitarization of the Rhineland.

The Stresa front was soon broken, however, when Great Brtain, taking a realistic view of Germany's rearmament, in June concluded a treaty with Germany whereby the latter was given the right to a navy thirty-five per cent as great as that of Britain.

The New Arms Race.—Germany was not the only nation to demand arms parity. Objecting to the 5 :5 :3 ratio, Japan at the end of 1934 gave notice that the Washington naval treaty of 1922 would terminate Dec. 31, 1936. Great Britain and the United States argued that the old ratio gave Japan perfect equality for defense, and that Japan's demand for parity was really an attempt at effective superiority. It semed to many that Japan wished to be better equipped for an aggressive course on the Asiatic mainland and to enforce her 'Far Eastern Monroe Doctrine.' Japan early withdrew from the naval conference which opened in London on Dec. 9, 1935, after her demand for parity with Great Britain and the United States had been refused. Italy too declined to sign any agreement to limit her navy, giving as reasons the continued presence of a large part of the British fleet in the Mediterranean and the recently completed Mediterranean pact which provided a united defensive front against a threatened attack by Italy, over the issue of oil sanctions (see below: *Italian Conquest of Ethiopia*). On March 25, 1936, however, the remaining conferees, France, Great Britain, and the United States, signed a three-power naval treaty, to run from Jan. 1, 1937 until 1942 (capital ps to be reconsidered in 1940). This in general limited the tonnage and gun caliber of most types of ships but permitted unrestricted construction within the given limits.

With the capital-ship holiday to terminate at the end of 1936, that year witnessed the inauguration of gigantic naval building programs on the part of the great powers. At the same time great increases were made in land and air forces, as the nations began a mad scramble to achieve equality or superiority in fighting strength. In spite of the supposed lessons of the World War, the nations apparently again believed that great armaments could secure peace. And again, as in the troubled pre-war days, the resulting international fear and suspicion threatened the peace.

The Quest of National Security.—While hoping for the best from the newly formed League of Nations and the international disarmament conference, the various countries of Europe did not, so to speak, put all their eggs into the basket of collective security, not even during the 1920's, before Japan, Germany, and Italy had flouted the League and eloquent gentlemen in Geneva had reached an impasse. Very soon after the war a series of international alliances and ententes sprang up which did not differ greatly from those which existed prior to the war.

France vs. Germany.—France's post-war policy derived directly from the memory of her terrible recent losses and a determination to prevent a recurrence of such a tragedy. With Germany inevitably playing the role of *bête noire* in French imaginings, France's program centered in the attempt to make herself internally strong while at the same time surrounding her late foe with a cordon of French allies. The first task confronting the country was the gigantic one of reconstruction in the devastated northern areas, and this was prosecuted with energy and at enormous expense. For the first time the State as a whole assumed the responsibility of making good the individual war losses. The cost, it was expected, would come from Germany.

However, even as expenses rose, Germany in 1921 asked for and received a partial moratorium on reparation payments. At this juncture France determined on a step which had the twofold purpose of convincing Germany that she could not evade her financial obligation and of hampering her economic recovery: in January, 1923, French and Belgian troops invaded the Ruhr (q. v.). The Ruhr venture was directed by Premier Poincaré, the war-time president and an extreme nationalist, who was determined to make Germany 'prefer the execution of the Treaty of Versailles to the conditions created by the occupation.' The English, already wishing to revive Germany both as a trade market and as a foil against England's traditional rival, France, opposed the Ruhr project. For their part the Germans began a policy of passive resistance which, as the mark sank to virtual nothingness, by September had admittedly failed. There followed the Dawes Plan of 1924 (see REPARATIONS) and the evacuation of the Ruhr. Germany, aided by foreign loans and soon on the road to economic recovery, began regular payments of reparation.

In spite of the French 'success' in the Ruhr, however, the franc was imitating the disastrous slide of the mark. When the franc had dropped to a value of two cents, Poincaré was called back to the premiership, to emerge ultimately as the 'savior of the franc' by stabilizing it at four cents. In view of this repudiation of 80 per cent (the franc had been worth almost twenty cents before the war) Frenchmen asked themselves wherein lay the value of winning the war.

Locarno.—The first phase of France's policy towards Germany, that of vindictiveness and force, had resulted in currency debacles in both countries. A second phase, of a more lenient and co-operative spirit, typified by the friendship of France's Briand and Germany's Stresemann, opened in 1925 with the Locarno treaties (see LOCARNO TREATIES). The chief meaning of these treaties to France was that if she were attacked without provocation by Germany, she would receive the armed assistance of Great Britain, Belgium, Italy, Poland, and Czechoslovakia.

In her quest of security, however, France did not repose her entire trust in the pledges of Locarno or the League. At Versailles she had hoped to secure promises of American and British aid if she were attacked again by Germany. But the United States had not signed the treaty and Britain, during negotiations in 1922, opposed a military entente. Nevertheless in 1920 France had made a defensive military alliance with Belgium against Germany, and this was followed by more or less similar agreements for mutual protection against German aggression—with Poland in 1922, Czechoslovakia in 1924, Rumania in 1926, and Jugoslavia in 1927. At the same time she was not only building up a powerful army and defenses of her own but was aiding the

development of her potential allies by judicious loans.

The Young Plan of 1930 supposedly settled the reparation problem by fixing the total amount due from Germany. A special reward to that country was the evacuation of the Rhineland in that year, without waiting until 1934. The world-wide economic crash, however, called forth the Hoover moratorium on intergovernmental debts, followed, July 9, 1932, by the virtual extinction of the German reparation debt, in Lausanne. In the minds of Europeans, reparation and the war debts due the United States had always been inextricably connected. Premier Herriot was forced to resign in December, 1932, for urging payment of France's debt installment.

Negotiations between Briand and U. S. Secretary of State Kellogg resulted in the Pact of Paris of August, 1928. Eventually signed by nearly all the nations, the pact condemned 'recourse to war for the solution of international controversies' and renounced it 'as an instrument of national policy.' Since, however, it was agreed that war in self-defense might be necessary, and since nations waging wars invariably plead 'self-defense,' the pact was little more than an idealistic gesture.

Central Europe and Balkans.—In Central Europe the chief cause of fear among the States which had gained by the war was Hungary's irredentism. In 1920 Czechoslovakia and Jugoslavia, interested in the maintenance of the Treaty of Trianon, which Hungary had been forced to sign, pledged mutual assistance in case of an unprovoked attack by Hungary. Similar alliances between Czechoslovakia and Rumania and Rumania and Jugoslavia completed the so-called 'Little Entente.' The Rumanian-Jugoslavian agreement looked also towards the maintenance of the Treaty of Neuilly, which had been imposed on Bulgaria. A convention of 1933 aimed at transforming the Little Entente into a permanent 'unified international organization.' The earlier bilateral treaties were renewed for an indefinite period and a permanent council, consisting of the foreign ministers of the three States, was organized. The co-ordination of the political and economic policies of the three States was also planned.

Security in the Balkans, provided in part by the Little Entente agreements and French treaties, was extended in 1934 by a pact among Greece, Rumania, Jugoslavia, and Turkey, which guaranteed Balkan frontiers against aggression by any Balkan State. Greece, however, weakened the effect of the pact by ratifying it only with the reservations that the boundaries guaranteed were internal to the Balkans, and that she was nowise committed to a war with Italy or any other great power. Bulgaria and Italian-controlled Albania had declined to enter the alliance, the former fearing that adherence might prejudice her claim to an outlet on the Ægean.

Eastern Europe.—In Eastern Europe the States bordering the Soviet Union—created largely out of former Russian territory—were likewise concerned with the problem of security. In 1921 Poland and Rumania formed a defensive alliance providing for mutual aid in the event of an unprovoked attack on the eastern frontier of either nation; this was extended in 1926 to cover all foreign aggression. In 1921 Poland and Czechoslovakia mutually guaranteed their frontiers with Germany. Estonia and Latvia in 1923 agreed on a program of mutual aid against attack, and in 1934 these two countries and Lithuania formed an entente looking towards co-ordination of their foreign policies. Nevertheless no common alliance for security was formed by the Baltic republics, chiefly because of the unwillingness of Lithuania, which was smarting over the loss of Vilna, to co-operate with Poland, and the general fear of the other Baltic States that Poland would dominate such a union.

The Soviet Union, which looked upon the Locarno pacts as a blow to her international position, in 1925 began to increase her efforts, thus far unsuccessful, to obtain nonaggression pacts which would eliminate the danger of concerted action against her. In December, 1925, Russia signed a treaty with Turkey under which each power agreed not to attack the other and to remain neutral in case the other were attacked by a third power or group of powers. A similar neutrality treaty with Germany (the first great power to recognize the Soviet government *de jure,* in the Rapallo Treaty of 1922) was signed in 1926. Other treaties of neutrality and nonaggression were signed with Afghanistan and Lithuania in 1926, Persia in 1927; France, Finland, Estonia, Latvia, and Poland in 1932; and in 1933 such pacts embraced all Russia's borderlands, the Little Entente, and Italy. Both Russia and France were somewhat alarmed by Poland's signing a nonaggression pact with Germany in 1934, but Poland promptly reassured France that the Franco-Polish alliance was as strong as ever, and the existing Polish-Soviet pact was extended. Also in 1934 an agreement among Russia, Poland, and Rumania guaranteed the existing frontiers of the three powers, thus ending the long friction caused by Russia's refusal to recognize Rumania's title to Bessarabia.

Advent of Hitler.—Germany's aggressive nationalism after Hitler's rise to power in 1933 awakened fresh fears among those nations interested in preserving the *status quo.* Even before Hitler's accession the countries of Europe had been divided into two general groups—those clamoring with increasing vehemence for revision of the peace treaties, and those beneficiaries of the peace settlement who wished to maintain things as they were. The former Allies, moreover, did not long preserve a common front in this regard, chiefly because of tension between Italy and France. Italy believed that France had not fully carried out the promise of colonial gains made to Italy in the Treaty of London of 1915; she felt that France had rendered precarious the status of Italians in Tunis; she envied France's hegemony in Central Europe, through the treaties with the Little Entente; was irked that Jugoslavia, Italy's new rival on the Adriatic, had been enabled to resist Italian pressure by French support; and resented France's refusal to concede to Italy naval parity. Accordingly Italy had championed Germany's and Hungary's demands for equality at the disarmament conference, and Mussolini made frequent, but vague pleas for treaty revision.

The increasing pressure of the revisionist countries led Great Britain in July, 1932, to reach agreements with France which virtually revived the Entente Cordiale. By the end of that year France, Great Britain, the Little Entente countries, Poland, and Soviet Russia comprised one group of States, while Germany, Italy, Austria, Hungary, Bulgaria, and Albania comprised a rival group.

In spite of overtures from the new German chancellor in 1933, Mussolini was not entirely pleased with the aims of his comrade in fascism. A German *Anschluss* of Austria would bring a powerful Germany into direct contact with Italy and might aggravate German irredentist activity in the southern Tyrol, which Italy had gained from Austria by the Treaty of St. Germain. Reluctant at the time to see Italy aligned with Germany against

Europe

France and Great Britain in a Europe split into two camps, Mussolini sponsored a four-power pact which was signed in July by Italy, Germany, Great Britain, and France, and which was promptly buried in the archives of the chancellories.

In 1934 the Soviet Union, disturbed by the activities of Nazi Germany in the west and imperialistic Japan in the east, was glad to become a member of the League of Nations. It was believed that Russia would strengthen the cause of collective security, especially since she had thrust the Third International into the background. France, who had sponsored Russia's admittance to the League, also sought the creation of an 'Eastern Locarno' to include Russia, the Baltic States, Poland, Germany, and Czechoslovakia, with the purpose of blocking German aggression in Eastern Europe. Germany and Poland, however, refused to sign any treaty of mutual assistance in that region.

More successful, for the time being, was France's attempt to entice Italy from an imminent alignment with Germany. By agreements signed Jan. 7, 1935, France ceded to Italy territory adjoining Italian Libya and Eritrea, and made other concessions, which went far to remove Italian resentment over the inadequacy of her colonial compensation following the World War. In the light of later developments it appeared that France further rewarded Italy for a shift to the French camp by giving tacit consent to the plans for the conquest of Ethiopia.

No effective action was taken against the rearmament of Germany in March, 1935 (see above: *Germany Rearms*). France, however, hastened to sign with Russia, on May 2, a pact of mutual assistance in case of an unprovoked attack in which the League Council did not agree as to the aggressor. (Germany argued that France's agreement to aid Russia in such a case contravened the Locarno pact, in which France had promised in no case to resort to war against Germany unless directed by the League). Great Britain sought to prevent a naval race with Germany by signing a naval agreement with that country in June.

Seizing upon a time when the great powers were divided over the Italo-Ethiopian conflict, on March 7, 1936, Hitler made his next major stroke: announcement of Germany's repudiation of the Treaty of Versailles and the Locarno Mutual Guarantee Treaty. Simultaneously, German troops marched into the Rhineland, the demilitarization of which had been provided for by both League and Locarno agreements. This step again drove Great Britain into the arms of France, while Italy's fear was evinced by her agreement with Austria and Hungary whereby the foreign ministers of the three countries were to consult periodically.

Italian Conquest of Ethiopia.—Early in 1935 Mussolini apparently decided on the conquest of Ethiopia (q. v.). He probably expected to encounter little interference from a weakened League, which had been unable to prevent Japan's acquisition of Manchuria, or from a Europe which needed his support against the menace of Nazi Germany. The League's attempts to compose Italo-Ethiopian differences proved fruitless, and the Italian military invasion of Ethiopia began October 3. The Hoare-Laval proposals in December for ending the conflict appeared to reward Italy with undue advantages in Ethiopia. Hoare was succeeded as British foreign secretary by Anthony Eden, a stalwart champion of League sanctions. Meanwhile a large part of the British fleet had been stationed at the entrances to the Mediterranean at Gibraltar and at the Suez Canal. Since Mussolini had declared that he would regard oil sanctions as involving war, Great Britain feared that their imposition might be followed by an Italian attack on the British fleet in the Mediterranean. By January, 1936, however, Great Britain was promised armed support in case of such an attack, by France, the Little Entente, Greece, and Turkey, and in return gave those nations similar assurances.

France had previously wanted, in return for her support of the British sanctionist policy against Italy, whose favor she had recently been courting, a promise of British aid in case of a future German attack on France. This Great Britain had refused at the time, preferring to take her chances without French assistance if necessary. France, nevertheless, had decided to support the League and Great Britain as the best bet for her own future security. For her part Great Britain feared that Italian success in Ethiopia might endanger her predominance in Northeast Africa.

Early in March, 1936, it appeared that oil sanctions were about to be approved. Hitler's remilitarization of the Rhineland, however, definitely ended the possibility of France's supporting an oil embargo. Towards the end of April it seemed that nothing could stop the triumphant advance of the Italian war machine in Ethiopia except the closing of the Suez Canal. This step Great Britain was not prepared to take, the reason given by Eden being 'her horror of war and not fear of defeat by Italy.' Mussolini announced the annexation of Ethiopia on May. 9.

Spanish Civil War.—With Germany, which had not taken part in the economic sanctions invoked in the Italo-Ethiopian war, Italy soon developed friendly relations which came to be spoken of as the 'Rome-Berlin axis.' In October, 1936, the two countries signed an accord pledging political and economic co-operation in the Danubian basin and granting Germany special economic privileges in Ethiopia. On November 18 the two powers simultaneously recognized the Rebel government of General Franco in Spain, where civil war had broken out the previous July. Italy and Germany openly helped the Insurgents with men and materials, while the Loyalists received unofficial help from Soviet Russia and France. Portugal was sympathetic to the Rebel cause, and, it seemed, Great Britain. Although the Non-Intervention Committee formed in London in September, 1936, representing twenty-seven nations, sought to localize the Spanish war through an international patrol, foreign materials and men continued to seep into Spain. European statesmen were in constant trepidation lest the Spanish conflict spread into a general war.

A tense situation was created in 1937 through the attacks on merchant ships, many of them bound for Loyalist Spain, by unidentified submarines and airplanes. Spanish Loyalists attributed these attacks to Italy. Following a conference in Nyon, Switzerland, in September, Great Britain and France, to whom was presently added Italy, undertook an anti-piracy patrol of the Mediterranean.

The strength of the Rome-Berlin axis was signalized in September, 1937, by a State visit of Mussolini to Germany. In November Italy, Germany, and Japan signed an anti-communist treaty in Rome; this supplemented a pact of one year previous between Germany and Japan, in which an exchange of military information and other measures of co-operation had been pledged. In December, 1937, Italy withdrew from the League of Nations.

German Conquest of Austria.—In March, 1938, Germany formally annexed Austria. The long-agitated *Anschluss* (union) of the small post-war republic, a project particularly dear to Hit-

Europe

ler, who was born in Austria, was effected without bloodshed, in the presence of thousands of German troops. Had the vaunted principle of racial self-determination been applied in this case, Austria would have become part of Germany right after the war. The Allies, however, particularly France, refused to countenance such an aggrandizement of their late foe Germany. The union of Austria with Germany was explicitly forbidden in the Treaty of Versailles and again whenever Austria was forced to accept foreign loans. In 1931 France managed to block a proposed Austro-German customs union. Apparently after the Nazification of Germany, however, a majority of the Austrians opposed *Anschluss*. In 1934, when Chancellor Dollfuss was murdered in an abortive Nazi *Putsch*, Mussolini threatened military action if Austria's independence were violated. Hitler disclaimed any interest in the unsuccessful *coup*. By 1938, however, Mussolini had doubtless realized the inevitability of *Anschluss* and too had probably been reassured that German irredentism would not extend to the Germans living in the Italian Tyrol. When Hitler visited Italy in May, Mussolini declared that the Rome-Berlin axis was as strong as ever.

Fall of Czechoslovakia.—The absorption of Austria sent new tremors of fear through Europe. The situation was particularly tense in Czechoslovakia, where many of the 3,500,000 German inhabitants belonged to the pro-Nazi Sudeten (the name of a mountain range) party and, incited by Nazi propaganda, were clamouring for autonomy. Threatened with the possibility that this minority would furnish Hitler with a pretext for making another Austria of Czechoslovakia, the leaders of the latter averred that their country would fight, if necessary, for its independence. Czechoslovakia counted on the promised support of France and Soviet Russia, while it was not unlikely that Great Britain, in spite of her refusal definitely to guarantee Czechoslovakian independence, would be drawn in on the same side in the actual event of war. By the end of May (1938) Hitler was ready to disclaim any territorial aspirations in Czechoslovakia, though tension there continued.

The Franco-British entente became a definite military alliance in April, with provisions for a unified command. As soon as either nation was attacked, the combined armies of both were to be placed under a French general, the navies under a British admiral, and the combined air forces under a British officer. The solidarity of the two nations was symbolized by a State visit of the British monarchs to Paris in July, 1938.

Great Britain, meanwhile, had been regaining a position of prime importance in European affairs. Prime Minister Chamberlain had embarked upon a pragmatic course of give and take in the field of diplomacy, and of dealing with the dictatorships of Europe directly, outside the framework of the League of Nations. Though his desire to improve Anglo-German relations had enjoyed little success (in spite of Hitler's belief that Germany should cultivate England's friendship), an accord signed April 16, 1938, seemed to mark the end of three years' tension —since the Ethiopian war—between Italy and Great Britain. Under this agreement each country promised to respect the other's interests in the Mediterranean, the Red Sea, and the Suez Canal; and Italy disclaimed all territorial or political designs on Spanish territory. The agreement was to become effective with the withdrawal of foreign 'volunteers' from Spain, a project which Great Britain vainly tried to expedite during the summer; but in any event all Italian forces were to be removed at the end of the war. Desiring peace at all decent cost, including reasonable concessions, Great Britain likewise pressed for a peaceful settlement of the Czechoslovakian minority problem. The Czechoslovak government tried to avert the coming conflict by offering to her dissatisfied minorities a "bill of rights," but Herr Henlein, the leader of the National Socialist party, rejected the concessions as inadequate and asked for complete autonomy for his group. The government refused this, however, and there was considerable agitation in Czechoslovakia and Germany by the Nazis, who declared they would use force if no other means were available. In mid-September, Prime Minister Chamberlain thought the possibility of war so great as to warrant a trip by plane to converse personally with Hitler. Meetings of September 15 and 22 between the two men did not alleviate the situation, and Chamberlain prevailed upon Mussolini to ask Hitler for a general conference which was held at Munich on September 30 with Great Britain, France, Germany, and Italy in attendance. Czechoslovakia was forced to cede all parts of the nation not possessing Czech majorities, and therefore to abandon its valuable system of fortifications. What was left of the state was powerless and dependent upon Germany. On March 15, 1939, the German army occupied the whole of Czechoslovakia.

The Months Before the Second World War.—On March 29, 1939, the democratic states were further deprived of potential allies by the collapse of all resistance to Gen. Franco in Spain. From then on, France had to watch the south as well as the north and east. England, too, could now expect some threat to Gibraltar from the new Nationalist Spain which was under strong obligation to assist the Fascist powers in any venture they might undertake. France was fast losing her allies in Eastern Europe; the loss of Czechoslovakia had been a fatal blow. The Balkans were uneasy over the amount of help they might expect from the Allies in the event they blocked Fascist or Communist aspirations in the East, for they had seen the fate of Austria, Czechoslovakia, and Spain.

As soon as the Czech republic had fallen, Germany demanded of Poland, on March 24, that Danzig be given to Germany except for a Polish free zone, and that Germany be given strips of land connecting Germany with East Prussia in return for a 25 year pact of non-aggression. For several months the usual war of nerves, for which the Fascists were noted, continued, with Polish Foreign Minister Beck refusing to concede what Germany demanded. Meanwhile, Italy had seized Albania on April 7, and seemed poised for a drive into the Balkans. Great Britain, on April 13, pledged full support to Greece and Rumania in the event that the independence of either was threatened and they put forth armed resistance. On May 12, the same pledge was given to Turkey. France confirmed each of these pledges, and furthermore, already had a treaty of mutual assistance with Poland. Britain declared on March 31 that she would go to the aid of Poland if that country resisted any aggression against itself.

All this diplomatic maneuvering occurred under pressure of great doubt regarding the position of the Soviet Union, which was most crucial in the Eastern European situation. The "Popular Front" government of France was out of office, replaced by a more conservative coalition under Daladier in April, 1938. The government of England was also Conservative, and, consequently, cooperation with the Communist government of Russia was difficult. But public opinion in the two countries de-

manded negotiations with Russia in the belief that that state was a natural enemy of Fascist ideology and aspirations in Eastern Europe. In April, 1939, Great Britain opened conversations with the Soviet Union regarding a mutual assistance pact, seeking guarantees by Russia of aid to Poland and Rumania in the event of attack from Germany. The Baltic States were also subjects for discussion. When these initial plans failed to please Russia, a new scheme was submitted for Soviet approval in May and again in June. In August, Britain and France sent a joint military mission to Russia to discuss the extent of Russian aid available for Poland and Rumania. The obstacles to final agreement which were encountered were the mutual distrust of the statesmen, the resistance of the Polish leaders to the thought of allowing Russian troops entry into Poland even if to defend the country, the desire of the Baltic states to remain neutral and their fear of Russia, and Allied hesitancy in giving broad commitments. Moreover, during this time, Russian leaders were negotiating with Germany for trade and nonaggression pacts. On August 19 a trade agreement was signed between the two countries, Germany promising to exchange machines and manufactured goods for Russian raw materials. The Soviet-German Nonaggression Pact was signed on August 23, and burst upon a startled and incredulous world. Enemies, who had hitherto seemed irreconcilable, now joined in an agreement to keep peace and consult with each other for a period of ten years. Assured of Russian neutrality, Germany was not inclined to retreat in the face of Allied determination to fight. Spurning any last minute compromise with its initial demands, Germany sent its troops into Poland on Sept. 1.

Second World War.—By Sept. 17 Germany had effectually overrun Poland by the tactics of lightning war, and by previous arrangement with Russia had allowed the latter country to occupy the eastern half of Poland. On Sept. 18, the two countries signed an agreement in Moscow, dividing Poland into a German and Russian Poland. During this period, the Allied armies remained inactive although their countries were officially at war with Germany beginning September 3.

The disappearance of Poland was only one of a large number of changes on the European map. On November 30, 1939, Russian forces launched an attack against Finland by land, sea, and air after Finnish attempts to compromise Soviet demands for strategic territory in Finland had failed. The short, bitter struggle ended with a Russian victory in March of 1940, and Finland surrendered 7,000 sq. miles of Karelia and 4,500 sq. miles in the North.

In April of 1940 Germany occupied Denmark and invaded Norway, which was completely conquered by May, when Allied troops were withdrawn to the southern fronts. On May 10, the German armies invaded Holland, Belgium, and Luxembourg. After a furious but brief resistance, the first two surrendered and were completely occupied by German forces. When France asked for an armistice on June 17, the Germans compelled a complete surrender for the period of the armistice of all of Northern France. The only small country untouched by boundary changes in Western Europe was Switzerland, where the Nazi war machine had not struck. In Eastern Europe Russia occupied the territories of Bessarabia and Bukovina without opposition from Rumania, and Rumania agreed to settle territorial differences with Hungary. The Baltic states, newly created after the first World War, once more were incorporated into Russia, this time as integral states in the Union of Soviet Socialist Republics.

Under pressure from the axis powers, Germany and Italy, Rumania was forced to concede half the territory of Transylvania to Hungary and one-third of the Dobruja to Bulgaria at the end of August, 1940. Carol was replaced as King of Rumania by his son Michael.

Economically, the continent of Europe was in desperate straits. Not only were millions of men out of productive enterprises, but the winter of 1939–40 was the most bitter in a generation, and the British blockade kept out sorely-needed food supplies and raw materials. See WORLD WAR, THE SECOND, and the articles under the various countries.

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Europe, Great War of, generally referred to as *The World War,* raged from July, 1914 until the Armistice of Nov. 11, 1918. The direct cause leading to the conflict was the assassination, at Sarajevo, Bosnia, of the archduke Francis Ferdinand, heir apparent to the Austro-Hungarian thrones, and his morganatic wife, the duchess of Hohenberg. This momentous tragedy occurred on Sunday, June 28, 1914.

The crime was committed by an Austrian subject of Serbian sympathies and would appear to have been a protest against the annexation of Bosnia and Herzegovina by the Dual Monarchy in 1908. Whatever his motive, the assassin, Gavrio Prinzip, a young student, was ultimately sentenced to twenty years and died in prison of tuberculosis.

On July 23 Count Berchtold, Austro-Hungarian foreign minister and prime fomenter of the war, issued an ultimatum with a 48-hour time limit to Serbia. The Serbian reply was duly delivered on the 25th. It was rejected by Austria-Hungary, and Berchtold declared war on the 28th. On the 29th the first shots rang across the Danube aimed at Belgrade, the Serbian capital. The World War had begun.

Such, in brief, was the 'origin' of the World War, but by no means the whole explanation. Behind, there lay a background of tangled and complicated history, a record of international rivalries, ambitions, plots and counterplots that took historians years to unravel and assemble into a fairly comprehensive picture.

After 1848, when the German States definitely rejected democracy, their rise to power and influence became extremely rapid, and the rate was further accelerated when, in 1866, Prussia wrested the Teutonic hegemony from Austria. The Franco-Prussian War of 1870 was followed in January 1871 by the re-establishment of the German Empire.

The new Empire found itself in many respects severely handicapped. A thoroughly decentralized nationality in the seventeenth and eighteenth centuries, owing to the decay of the Holy Roman Empire, Germany had no share in the great fruits of the era of colonial expansion. She was thus compelled to see a considerable part of her youthful energy absorbed in other countries. The surplus products of her industry and science were forced to find markets outside of her dominions, under all the disadvantages of foreign competition. She suffered materially from the lack of producing grounds of raw material, especially in the tropical and semi-tropical zones.

What was Germany doing to fill this need for new territory and new markets under her flag? Within thirty years she had acquired colonial possessions in East, Southwest, and West Africa, some islands in the Pacific, and a valuable land concession in China, Kiao-chou (q. v.). These totalled the not inconsiderable area of over 1,000,000 square miles; but they were not, for the most part, in the more favored portions of the earth; their development was a difficult matter, and they were proving very costly. A greater opportunity seemed to lie through Southeastern Europe, where the Ottoman Empire was tottering to its fall. Germany dreamed of Austro-Hungarian extension to the Ægean, and at least a protectorate for herself over Turkey, unless, indeed, it should fall to her share in the partition of the Porte's dominions. The chief obstacle to this lay in Russia, whom, until the settlement of the War of 1877–8 (see RUSSIA, *History*) put a new complexion upon the vexatious Eastern Question (q. v.), Germany had sought as an ally, but had later regarded as a serious rival. Nevertheless, she was optimistic enough to undertake the Bagdad Railway (q. v.), and continued to entertain visions of a German Mesopotamia and a clear way to the Orient.

By the end of the 19th century, the German Empire ranked with the Great Powers of Europe; she possessed the most powerful army the world had ever seen; she was rapidly bringing her navy to a high state of efficiency, and beginning to assert herself in the crisis of *Weltpolitik*—if, indeed, she did not have a hand in creating many of them. Such political squalls as the Morocco Incident of 1905 and the Casablanca Affair of 1907 (see MOROCCO); the annexation of Bosnia and Herzegovina in 1908, destroying the integrity of the Treaty of Berlin; and the performance of the *Panther* at Agadir in 1911, were calmed by the threats and promises of the industrious statesmen of Europe before they reached the dignity of tempests; but many far-seeing minds were becoming increasingly convinced that the peaceful solution of such international problems could not indefinitely be expected, especially when the finest hopes and chances of a Pan-Germanic world empire presently vanished in the smoke of the Balkan Wars (see BALKAN WAR).

In 1912 the Slavic nations of the Balkan Peninsula, together with Greece, formed a league, and, backed by Russia, proceeded to settle, once and for all, their grievances against the Turks. It is easy to see that the partition of European Turkey among those States would destroy Austria's chances of obtaining Macedonia and an outlet on the Ægean, and would wreck Germany's plans in regard to the Ottoman Empire, the modernization of whose military arm she was at the time actively supervising. But William II did not interfere. Although several pretexts offered themselves to Austria to enter the conflict, Germany tempered the ardor of her ally, and the Triple Entente procured substantial satisfaction by creating the independent State of Albania, and thus keeping Serbia from the sea. The outcome of the war was, however, about as unfavorable as it could be for the Middle Empires; and the Second Balkan War of 1913, provoked by Austrian diplomacy, which put all its faith in the Bulgarian army, was equally disastrous from their standpoint. But it appears that Austria did not give up her intention of attacking Serbia. According to the revelations made (December, 1914) by Signor Giolitti to the Italian Parliament, it is certain that, before the end of 1913, Austria had acquainted Italy with this fact. William II had shown at different times his desire to maintain the peace of Europe, and he held this attitude until toward the end of 1913. Russia was rapidly recovering from her struggle with Japan and was planning a railway system of great strategic value in Poland.

The Franco-British Entente, according to the *War Memoirs* of Lloyd George, was the cover for a secret foreign policy which committed Great Britain to military action to a degree of which even the Cabinet was unaware. 'These measures,' wrote the British statesman, 'came to my knowledge, first of all, in 1911, during the Agadir crisis, but the Cabinet as a whole were not acquainted with them before the following year'; when Sir Edward Grey, Foreign Minister, communicated them, 'the majority of the Cabinet were aghast.' While it may justly be said that Grey gave too little information to his colleagues, it was equally true that many of them were so absorbed in domestic issues that they never insisted upon being fully informed about foreign affairs.

However this may be, when the issue of peace or war confronted Great Britain in 1914, it

was not the commitments with France which immediately brought the country into the war but the conviction, according to Lloyd George, that toward Belgium 'we were in honour bound to discharge our treaty obligations.' With the possible exception of 'the foolish Berchtold' (of Austria-Hungary), it subsequently became clear that not one of the major European powers really wanted war.

Other considerations apart, France was fully occupied in entirely remodelling and increasing her military equipment. England was considering radical changes in her navy, and the opposition to Irish Home Rule (q. v.) indicated temporary internal weakness. These countries were the ones most likely to oppose the Teutonic coalition.

Diplomatic History.—The Sarajevo assassinations contained some decided elements of mystery, which were made the more prominent by the attitude of the Court of Vienna toward the murdered pair. Francis Ferdinand was probably the last member of the house of Habsburg whom a Slav patriot would be thought of as choosing for his victim, because his announced policy was to break up the dual system and substitute a true federation of the various States of the Empire, under which the different races were to have real autonomy and find union in a federal parliament. This plan, which evidenced an enlightened political vision and would help in the solution of the complex race problem with which the Dual Monarchy was confronted, was vigorously opposed by the conservative statesmen, and the Archduke was highly unpopular in Vienna.

Austria declared that the murder plot had originated in Belgrade; that it was organized, if not by the Serbian government, at least by secret societies which it tolerated and protected; and that measures must be taken to prevent similar outrages. On July 23 Berchtold sent an ultimatum to this effect to Belgrade. Among the demands was one that judicial proceedings be taken against accessories to the Sarajevo crime, and that delegates of the Austro-Hungarian government should take part in the investigation relating thereto. The time condition was most unusual, and apparently unreasonable, since it gave the Powers very little time in which to prevent a rupture; while, to increase the difficulty, the President of France and Premier Viviani were at sea after their departure from a visit to the Russian capital, the German Emperor was cruising in Norwegian waters, the Russian ambassador at Vienna was on leave of absence, and the French Minister at Belgrade was ill and away from his post.

Until March, 1918, it was a more or less mooted question whether Berlin knew the terms of the ultimatum before it was dispatched. Many facts of the case were familiar as early as the outbreak of the war; but, having been divulged confidentially to fellow diplomats and lacking documentary evidence, these could not well be made public. The last doubt was ended, however, by the revelations of Prince Lichnowsky (q. v.), the pre-War German Ambassador at London, and Dr. Mühlon, the former Krupp Director, and the indirect testimony of as reliable witnesses. The assassination of the Archduke served as an excellent pretext for a war which had already been planned.

On July 25, within the stipulated time, Serbia sent her reply, accepting the conditions as prescribed except the two that concerned the co-operation of Austrian officials. These were granted with certain reservations, or, as an alternative, reference to The Hague tribunal was proposed. Thereupon Austria peremptorily announced that the reply was unsatisfactory; within a few minutes after its receipt broke off diplomatic relations with Serbia; and declared war on July 28.

Meanwhile, the rulers and diplomatists of Europe were straining themselves to the utmost over the alarming situation. Without going into the details of their correspondence between July 24 and 30, its essential points, in the order of their development, are as follows:

1. Germany contended that the question concerned Austria and Serbia alone, and that the former must have a free hand to settle it. Any intervention would have 'incalculable consequences in bringing the alliances into play.'

2. Russia announced that she would not desert Serbia in her hour of danger; that, once conquered, the little kingdom would become an Austrian dependency, and the preponderance of Slavic power in the Balkans would be overthrown. Nevertheless, in case Austria did attack, she announced her purpose to continue negotiations in order to prevent a general war.

3. Germany asked England to use her influence at St. Petersburg in favor of non-intervention. England answered that she was not justified in doing so, but offered to join with France, Germany, and Italy in an endeavor to smooth matters between Russia and Austria; but Germany reiterated that she could not interfere.

4. Germany repeated to France the request made to England, adding that 'Germany is on the side of France in her ardent desire to maintain peace.' But France also refused to use her influence, on the ground that this would indicate her acquiescence in the idea of giving Austria a free hand.

5. M. Sazonov, the Russian Foreign Minister, told the British Ambassador that he did not believe Germany wanted war, and that, if Great Britain now declared herself on the side of France and Russia, Germany would curb Austria and there would be no war. Otherwise, he declared with prophetic vision, 'rivers of blood will flow and you will be dragged in eventually.'

6. Though peace concerned her greatly, England replied that the Austro-Serbian quarrel did not affect her interests, and that she wished a free hand to act in the future.

7. Russia offered to guarantee the result if Austria would withdraw her ultimatum, respect the sovereign rights of Serbia, and promise that she would not make of her an Austrian dependency.

8. England proposed that the four Great Powers not affected by the quarrel (England, France, Germany, and Italy) should intervene as mediators, and that Russia, Austria, and Serbia should abstain from all military activities pending the result of their efforts. This scheme found great favor with France and Italy. Germany accepted the principle of mediation, but refused a conference, on the ground that Austria and Russia should not appear before a court of arbitration. Meanwhile—

9. Russia offered to confer directly with Austria, but Germany refused to advise the latter to accept this proposition.

10. Germany warned the other Powers that if Russia came actively to the assistance of Serbia, a general war would result. This was on July 28, the day that Austria declared war.

11. William II returned from Norway (July 28) and telegraphed the Tsar that he would use his influence for a peaceful settlement of the Serbian question, but that Russia, in any event, ought to stand aside.

12. Russia announced a partial mobilization (July 29), but assured Germany that she had no aggressive intention toward her.

13. Germany answered that if Russia did not stop at once, her own army would receive mo-

bilization orders; whereupon Russia ordered further mobilization.

14. The Imperial German Chancellor, von Bethmann-Hollweg, informed the British Ambassador at Berlin that if Great Britain would stand aside in case of war, Germany, if victorious, would seek no territorial aggrandizement at the expense of Continental France; but—in response to a question—would make no promises in regard to the French colonies. The neutrality of Holland would be respected, but that of Belgium would depend upon the action of France (July 29). Great Britain still stood out for liberty of action.

15. Austria declared a general mobilization, and Russia followed suit. The German Ambassador at St. Petersburg demanded that Russia stop at once all military preparation.

16. Austria suddenly became conciliatory. She offered to accept mediation, and informed Germany of the fact (July 31).

It was made to appear that Vienna now realized for the first time the extreme seriousness of the situation. A dim foreshadow of the greater crash to come may have made her hesitate—till lost. Ultimatums to Russia and France were being despatched by Germany on that day. In her impatience she had taken matters into her own hands. It was Russian demobilization or war, and the former was actually ordered by the Tsar. His command was ignored only because the Russian Minister of War, General Sukhomlinov, was not blind to the inevitable trend of events.

The Austro-Serbian quarrel almost faded out of sight and the world thrilled to the spectacle of the great German and Russian empires drawn up for battle. Germany was facing France also, who must be crushed first, but the Russian mobilization progressed more rapidly than was expected. France and Russia were allies, forming the Dual Alliance. Both of them had friendly understandings with Great Britain, and the three made up the 'Triple Entente' or the 'Entente Powers.' Opposed to them stood the Triple Alliance (q. v.), composed of Germany, Austria-Hungary and Italy. So far as Italy was concerned, the alliance was purely defensive; that was why Italy stood aloof in 1914, because neither of her allies was *attacked*. Italy had also refused to countenance Austria's proposed attack on Serbia in 1913. Furthermore, Italy had stipulated in both her treaties with Germany and Austria that she would not participate in any conflict if Great Britain should stand on the opposite side.

'Scrap of Paper' Incident.—On August 3 German troops invaded Belgium; on the 4th, Great Britain despatched an ultimatum to Germany demanding a reply by midnight. The question was, would Germany respect the neutrality of Belgium? The reply was 'No.' Late in the evening the British Ambassador in Berlin, Sir Edward Goschen, called on the Imperial Chancellor in a final effort to save Belgium. The Chancellor was 'very agitated,' Goschen reported; just for 'a scrap of paper' Great Britain was going to make war on a kindred nation who desired nothing better than to be friends with her.

Declarations of War were launched on the dates shown below:

1914.—Austria-Hungary *versus* Serbia, July 28; Germany v. Russia, Aug. 1; Germany v. France, Aug. 3; Germany v. Belgium, war without declaration, Aug. 4; Great Britain v. Germany, Aug. 5 (12.15 A.M.); Austria-Hungary v. Russia, Aug. 6; Montenegro v. Austria-Hungary, Aug. 8; Serbia v. Germany, Aug. 9; France v. Austria-Hungary, Aug. 10; Great Britain v. Austria-Hungary, Aug. 12; Montenegro v. Germany, Aug. 12; Japan v. Germany, Aug. 23; Japan v. Austria-Hungary, Aug. 26; Austria-Hungary v. Belgium; Russia v. Turkey, Oct. 30; Great Britain and France v. Turkey, Nov. 5; Turkey v. Belgium, France, Japan and Russia, Nov. 27.

1915: Italy v. Austria-Hungary, May 23; San Marino v. Austria-Hungary, May 23; Italy v. Turkey, Aug. 20; Russia v. Bulgaria, Oct. 4; Bulgaria v. Serbia, Oct. 14; Great Britain v. Bulgaria, Oct. 15; France v. Bulgaria, Oct. 16; Italy v. Bulgaria, Oct. 18.

1916: Germany v. Portugal, March 9; Roumania v. Austria-Hungary, Aug. 27; Italy v. Germany, Aug. 27; Germany v. Roumania, Aug. 28; Turkey v. Roumania, Aug. 30.

1917: United States v. Germany, April 6; Cuba v. Germany, April 8; Panama v. Germany, April 9; Greece v. the Central Powers, July 2; Siam v. the Central Powers, July 22; Liberia v. Germany, Aug. 4; China v. Central Powers, Aug. 14; Brazil v. Germany, Oct. 27; United States v. Austria-Hungary, Dec. 7; Panama v. Austria-Hungary, Dec. 10.

1918: Guatemala v. Germany, April 25; Nicaragua v. Germany, May 7; Costa Rica v. Germany, May 25; Haiti v. Germany, July 15; Honduras v. Germany, July 19.

All the smaller nations took no active part in the war, but their declarations of war indicated where their sympathies lay. Several other Latin American nations severed diplomatic relations with Germany. Salvador remained neutral. The United States did not declare war on either Turkey or Bulgaria, but the former severed diplomatic relations with the United States on April 20, 1917.

Strength of the Armies.—In the first period, Germany had greatly the advantage, both in numbers of fighting men and supply of munitions. In August, 1914, she had available 4,500,000 men, and these were rapidly augmented by additions of 800,000 and the calling up of the class of 1914, a further 450,000 effectives. In subsequent years, Landsturm (final reserve) forces were called up, as well as successive annual classes of young men down to and including the class of 1920; including wounded men discharged from hospital and returned to the front line, Germany's total war strength amounted to 11,000,000 men.

Austria-Hungary entered the conflict with 1,000,000 men, and within six months she tripled that figure; the total number she enrolled before the close of hostilities was 6,500,000.

At the outset of the war France mobilized 1,500,000 soldiers, a total which she increased to 5,000,000 within half a year; subsequently she called many additional men to the colors, but because of the unceasing losses the total at any one period never exceeded 6,500,000.

Great Britain raised 5,704,416 men for military service, to whom must be added 1,460,864 provided by the various Dominions, and 1,524,187 Indian and other colored troops, making a total of 8,689,467 for the British Empire.

Russia had 5,000,000 men more or less ready for action when the war began, and before she threw up the sponge in the fall of 1917 she had contributed altogether 12,000,000 soldiers to the common cause; the fact that her losses were disproportionately higher than those of any other combatant was due in large measure to her appalling lack of equipment.

One-fourth of the population of Serbia was mobilized, 707,343 men rallying to the colors; 46 per cent of them became casualties. Italy sent 5,615,000 men to war, and of the other Allies, Japan contributed 800,000; Roumania, 750,000; Belgium, 267,000; Greece, 230,000; Portugal,

100,000; and Montenegro, 50,000. On the side of the Central Powers, Turkey provided 2,850,000 men, and Bulgaria 1,200,000.

The United States contributed 545,773 regular troops, 728,234 volunteers and 2,783,094 drafted men, a total of 4,057,101; to these must be added marines serving with the army in France and men in naval vessels, giving a total figure of 4,355,000 men.

Western Front.—The German plan was to make a sudden invasion of France in her comparatively weak condition, reduce her to impotency, and thus leave Germany free to deal with Russia, who, it was believed, would be very slow in mobilizing. To accomplish this, Germany prepared for and expected to make great sacrifices, counting upon three factors—time, extreme mobility, and overwhelming numbers. To gain time and be at the gates of Paris within two weeks, she planned to sweep unopposed into France through Belgium, and not across the strongly fortified border facing Alsace and Lorraine.

This move gave a moral shock to the rest of the world, for Prussia, with the other Powers including Great Britain, had guaranteed to respect Belgian neutrality in a treaty made in 1839. The German argument and excuse in the matter was presented by the Imperial Chancellor, Dr. von Bethmann-Hollweg, in the Reichstag. He said: 'We are now in a state of necessity, and necessity knows no law. We were compelled to over-ride the just protests of the Belgian and Luxembourg governments. The wrong—I speak openly—that we have committed we will endeavor to make good as soon as our military goal is reached. Anybody who is threatened as we are threatened, and is fighting for his highest possessions, can have only one thought—how he is to hack his way through.'

Upon the invasion of Belgium, Great Britain entered the war, The Belgians refused the requested permission to march through their country, and determined in all their small power to resist; and here is where the time factor began to fail. The grand-duchy of Luxembourg, also inviolate by the Treaty of London (1867), was occupied against protest by German troops on Aug. 2.

The entry into Belgium was eventually made over four routes: through Luxembourg; into the Southern Ardennes; into the Northern Ardennes in the direction of the Meuse, between Namur and Dinant; from Aix-la-Chapelle close to the Dutch frontier, across the Meuse at Visé, and up the valley to Liége. The vanguard of the invaders took the last route on Aug. 3, for the very first thing to be done was to capture the strong but ill-equipped ring of forts surrounding Liége, which would open the railway system into France. The striking force consisted of three divisions of General von Kluck's army under General von Emmich, and the first shots were fired on the afternoon of Aug. 4. Liége (q. v.) was defended by a force of 20,000 under General Leman. Their resistance was stubborn but unavailing. On Aug. 5 the chief fort on the southeast was silenced; on Aug. 7 the city was entered, and other forts fell. An important one to the northwest, which commanded the railway, attacked on Aug. 13, held out till the 15th, when von Kluck's forces were free to join the armies of Von Bülow and Duke Albrecht of Würtemberg, which had penetrated the Ardennes and were waiting in the vicinity of Namur and Dinant.

The quick fall of Liége, one of the strongest places in the world, showed beyond dispute that a revolution had been worked in the art of warfare, and that massive permanent earthworks must go into the military scrap heap along with the city walls and masonry forts of olden times.

Aided by the railway, von Kluck now moved rapidly toward his fellow generals, his cavalry acting as a screen, and sweeping Belgian garrisons and other small bodies of troops from the path. A triumphal entry was made into Brussels on Aug. 20, whence the government and the greater part of the active Belgian army had fled to Antwerp three days before. The attack on Namur began Aug. 20; by Aug. 23 the Germans were in possession. The sudden collapse of this stronghold was an unexpected blow to the Anglo-French resistance.

Alsace-Lorraine.—No less than the Germans, years before hostilities commenced the French staff had worked out a plan of attack, predicating it upon an assumption of the probable line of German invasion. Unfortunately for the French, they believed that a headlong advance on their eastern frontier would check the main German offensive, and therefore, in the first week of August, their active army of a million men swept into Alsace-Lorraine. As shown above, the Germans were in fact swinging their main battle forces through Belgium, and by the time the French had realized their mistake and were able to transfer their vast armies to the west, the German invasion was already well under way. Finding the resistance slight, by Aug. 20 the Vosges region, including Mülhausen, was in French hands. Saarburg was captured and rail connection between Metz and Strassburg cut off. Paris went wild with joy at the news that the tricolor was again flying in the 'lost provinces.' But it was short-lived. Four German corps came from the north and overpowered the French left wing. The center, in the Vosges, had to give way, as well as the right on the plains of Alsace. The defeat was decisive, and terribly severe for the left. By Aug. 22 the entire region was cleared of the French, who barely managed, through the activities of the Battle of the Marne, early in September, to save Nancy from capture. But a strip of Alsace remained in French hands throughout the war. Protected by the nature of the terrain, this part of the front gained the name of the 'quiet' sector.

The Channel Ports.—On the approach of General von Kluck, in August, the main part of the Belgian field army had retired from Brussels to Antwerp, whence columns of attack, chiefly cavalry, were sent out against the detached forces of the invaders which were occupying the country around the capital. The spirit of the Belgian troops was high, but they were too weak in numbers for effective accomplishment while the civilian population, men, women, and even children, incensed beyond reason at the violation of their country, indulged on several occasions in violent guerrilla warfare, which, in accordance with the German system of reprisals, resulted in terrible destruction of property and life. To this must be attributed most of the bloody and incendiary deeds at Louvain (where a section of the city was destroyed, Aug. 26), Dinant, Aerschot, Termonde, and other places. Heavy fines were, and continued to be, imposed upon the cities. Brussels had to submit to an immediate tax of $40,000,000. Some British troops which were landed at Ostend on Aug. 27 assisted the Belgians to regain Malines (Mechlin), Sept. 13, and to keep up a fruitless struggle to get at the enemy's rear and lines of communication.

These activities quickly ceased when the Germans began to carry out their new plan. This was to gain control of the northeast coast of France, and drive a wedge between France and England. With Dunkirk, Calais, and Boulogne in their hands, an excellent base of operations against both countries would be obtained. Before this could be

done, however, Antwerp and Lille had to be taken.

The siege of Antwerp (q. v.) was begun by General von Beseler on Sept. 27. The city was defended by the main portion of the Belgian active army and some British troops, but, as at Liége and Namur, the great fortress crumbled before the heavy German and Austrian artillery. By Oct. 9 the forts of the first line were taken, and the Germans entered the city (Oct. 10) just after King Albert and his ministers had left for Ostend.

The fall of Antwerp released several German corps for the drive at the Channel ports. These moved rapidly along the coast. On Oct. 13 the seat of the Belgian government was removed from Ostend to Havre, where the French gave it privileges of extra-territoriality. King Albert remained with his army. Ostend was in German hands on Oct. 15. Meanwhile another Teuton force extending the main right wing captured Lille (Oct. 12).

The Allies were prompt to meet the new move of the enemy. It was decided that Sir John French's army should be withdrawn from the trenches along the Aisne, French reserves taking their place, and should extend the Allied line from in front of Lille to Ypres and beyond. The Belgians, retiring from Ostend before the oncoming Germans, completed the line of defense to the North Sea. Against this the Germans advanced. They were stopped at the Yser between Nieuport and Dixmude, Oct. 18, by the stubborn Belgian resistance. A small fleet of French and British warships constituted the extreme left of the Allied line, and inflicted severe and constant losses upon the enemy. Some German detachments managed to cross the Yser Canal on Oct. 25, but the Belgians opened the sluices and flooded the region and they were obliged to fall back. The attempts to break through extended south through Ypres and La Bassée to Arras. The most violent occurred in the neighborhood of Ypres, where the first Battle of Ypres was fought (Oct. 27). Against a force greatly superior in numbers, the British held the city, but suffered losses amounting to 50 per cent.

After this, the German offensive diminished in intensity. The attempt to reach the Channel, like the move on Paris, had failed. Gradually the offensive changed to the defensive. The reason for this was that an alarming situation had developed on the Eastern frontier, necessitating the withdrawal of troops from the West, and causing another change in the German strategical plans. (See EASTERN FRONT, below).

Retreat From the Frontiers.—Despite the fact that the Germans had failed in their attempts to reach the Channel ports, their strategical situation in the west was immeasurably superior to that of the Allies. As shown above, the dramatic rush into Alsace-Lorraine on the east had been followed by an equally precipitate retreat; the Belgians had been overborne by sheer weight of numbers from the outset; and the attempted Franco-British advance into Belgium on the north had come to a halt.

All these reversals had materialized during the first weeks of August, and when Lanrezac, commander of the French Fifth Army, lost the crossings of the Sambre on Aug. 23, he was forced to retire in order to protect his right flank from the oncoming Germans. The British, on his left, were compelled to conform to the French withdrawal, and soon the whole of the main Allied armies were in rapid retreat into France from the Mons-Namur line.

The British were particularly harassed, both because they were a day behind the French and because von Kluck was attempting on the west, with one corps and a large force of cavalry, to envelop them and turn their flank. On Aug. 25 their position was one of extreme danger. They were now on a line from Cambrai through Le Câteau to Landrecies, had broken connection with the French, and were without support except the fortress of Maubeuge, which, left isolated by the retreat, was promptly invested by the enemy. On Aug. 26 the one corps of General Smith-Dorrien, holding back four German corps, looked in vain for some expected cavalry assistance from the French, and it narrowly escaped capture or annihilation. (Maubeuge held out until Sept. 7, and not till then did the Germans have full control of the lines of communication through Belgium). On the following day (Aug. 27) the Anglo-French got their first rest on the line Noyon—La Fere-Laon. Then the French, with the reinforcements now arriving from the eastward, made a sharp attack at Guise, and succeeded in bending back the German line for a considerable distance. This advantage was not pursued, however, by General Joffre, the French commander-in-chief, who, on Aug. 29, again took up the retreat toward Paris. Meanwhile the pursuing enemy, their enveloping movement sweeping westward as far as Amiens, crossed the Marne, and also occupied Rheims and Châlons. When, on Sept. 2, the retreat came to an end, the opponents faced each other on a line whose western extremity was perilously close to Paris, and thence continued in a deep bend through Vitry-le-François on to Verdun, now encircled by the Crown Prince's army, and southeast to the neighborhood of Nancy. (See MONS AND SAMBRE, RETREAT FROM).

Battle of the Marne.—The main invading force of the Germans had been drawn to a point where it was confronted with superior numbers, but so imminent was the capture of Paris that the government and great financial institutions were removed to Bordeaux on Sept. 2. The German right now turned eastward, its main columns marching upon Laon and Rheims in the hope of breaking through to Paris by the left. The Allied commanders determined to assume the offensive, and did so on Sept. 6. Joffre, in the order of the day, told his soldiers that upon the battle now to begin depended the fate of their country.

The line was 200 miles long, from southwest of Soissons almost to the Swiss border, and was occupied by 3,000,000 men. On the west it stretched through the valley of the Marne, which has given its name to the battle. Von Kluck was still looking for a chance to get at Paris by his left. Duke Albrecht of Würtemberg drove at the French center for four days before he was forced back. Meanwhile, a new French army of reserves (re-enforced to 150,000) had been rushed in every available taxicab and motor-bus from Paris (by the wisdom and energy of General Galliéni, then military governor of Paris) to the banks of the Ourcq, where, under the leadership of General Maunoury, they persistently attacked the German right until, on Sept. 10, joined by Sir John French, they made an overwhelming and successful assault upon von Kluck. General Foch, who had been attacking the German center and right, thrust a wedge between them, and drove his opponents into the swamps of St. Gond.

This bent the German center back. Rheims was retaken, and by Sept. 11 the Germans were in retreat all along the line. The pressure upon Nancy was relieved, and Sept. 12 marked the end of the first battle of the Marne. The Germans had retreated to a line of trenches they had prepared along the Aisne. (See MARNE, BATTLES OF).

First Battle of the Aisne.—The Battle of the Marne cost

half a million men, and brought no decisive results. The Germans were thwarted in their attempts to reach Paris; the Allies failed to drive them out of France. The line of the Aisne, at which the Anglo-French drive came to a halt, was an excellent defensive position, carefully chosen for its topographical advantages, where the Germans further protected themselves by trenches, entrenchments, barbed-wire entanglements, and shelters of all kinds, prepared according to the most approved methods of military science, and capable of standing a prolonged siege. It extended from a point north of Compiègne in the direction of Soissons and Craonne, ran between Rheims and Réthel, and encircled Verdun on the north and east, where presently it was joined by other German armies—the fifth and sixth—under the Crown Prince of Bavaria and General von Heeringen, which had followed the French retirement to the Verdun-St. Dié line. The German left wing rested on Metz.

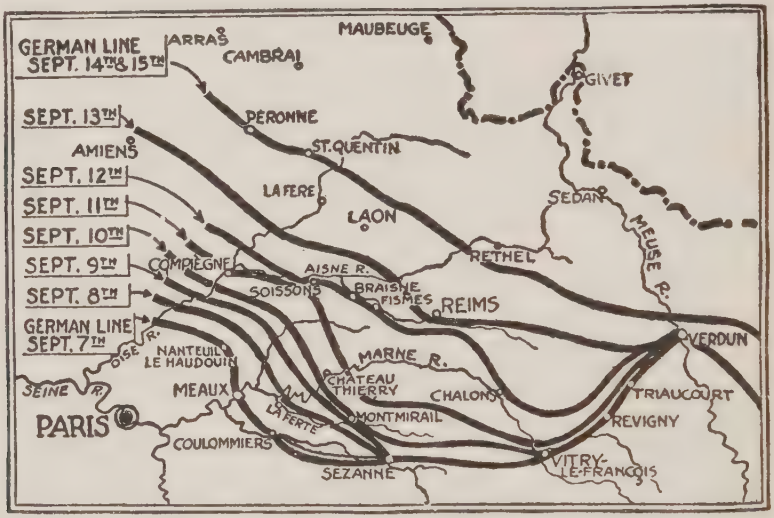
The Battle of the Aisne—in reality a whole campaign—is the name given to the succession of attacks on and by the German left and center, beginning with the hard-contested passage of that river by the Allies near Soissons on Sept. 13, and continuing until the second week in October. The Imperial Crown Prince retreated from Verdun, and there was hard fighting around Berry-au-Bac and Rheims, where the invaders lost ground, whereupon Rheims was bombarded (Sept. 19 *et seq.*) and its famous Cathedral partially destroyed.

But the more important actions were further west. Here the Allies tried to turn the German right and force a general retirement to the Meuse; the Germans tried to pierce the French left and threaten Paris anew. General Joffre gradually extended his lines north and west, and the Germans had to abandon Amiens and other places in Normandy which they had entered. By Sept. 26, the Allies had worked their way as far as Lassigny and Péronne, and had gained ground on the Oise. The Germans met them between St. Quentin and Tergnier with troops drawn from Lorraine. By Oct. 2 the fighting lines had mounted as far as Arras, where a violent battle developed on the 5th. By Oct. 9 the cavalry screens of both armies had already clashed in the vicinity of Lille (Oct. 8), and were close to the North Sea. Meanwhile, the Germans had appeared on the heights of the upper Meuse south of Verdun and forced a crossing, but were kept from further advance by French forces from Toul and Nancy.

By Oct. 20 the western extremity of the line had been extended from its position on Sept. 10 to Lille on the north, by way of Noyon, Roye, Albert, Arras, Lens, and La Bassée, while on the east it ran from Verdun southeast, forming a sharp salient on the heights of St. Mihiel on the upper Meuse—'an arrow,' as Joffre expressed it, 'pointed straight at the heart of France'—then eastward to the north of Nancy, reaching Arracourt and Avricourt, and thence to Belfort. From now on the struggles over this long front decreased in violence and importance, because the German General Staff had formed new plans and were putting them into execution. (See AISNE, BATTLES OF THE).

The First Winter.—A military critic has characterized the war on Germany's Western front as one of long battles and short sieges. It would perhaps be more accurate to describe it as a long siege without investment. After the practical cessation of the German offensive, at the end of October, 1914, the story becomes, for some months, one of constant artillery duels along the entire line, desperate and costly attempts to gain trenches over barbed-wire entanglements and across flooded country, close fighting with bayonets and hand grenades—all of which resulted in but small local advantages, and had no effect upon the general situation, except that Germany, realizing that she could not be driven out of France and Belgium, was enabled to exert extraordinary pressure against Russia.

During the winter, while Great Britain was bending every effort toward increasing her forces, and France was reorganizing her armies, Germany devoted her industrial energy to improved means of offense. Her scientists were set to work to invent and devise new methods of warfare, and they produced such curious weapons as asphyxiating gases and flaming liquids. More powerful shells were made, and she



The German Retreat from Sept. 7 to Sept. 15, 1914.

was better provided with ammunition of all kinds than any of her adversaries.

Along the whole Western front the months of November and December, 1914, passed in comparative inaction. German attacks in the vicinity of Ypres failed, but Dixmude was captured from the Belgians (Nov. 10), an achievement nullified by the extensive flooding of the surrounding country. The seizure of the 'ferryman's house,' on the left bank of the Yser (Dec. 2), gave the Allies one of the strongest positions in that region, resulted in the German evacuation of that bank (Dec. 12), and placed the Belgian army solidly on the right bank (Dec. 23). The French stopped several German attempts to cross the Aisne in November and December, but they could make no impression upon the St. Mihiel salient. Nevertheless, the French government had sufficient confidence in the situation to return to Paris on Dec. 10.

The Year 1915.—Their reverses on the Yser spurred the Germans to increase their activity upon the Aisne. On Jan. 8, 1915, a violent blow was delivered north of Soissons. The French drove the Germans back, and got across the river, but the sudden flooding of the stream (Jan. 13), carrying away two bridges necessary for the transport of big guns, compelled them to retire to the south bank for a stretch of over a third of a mile. The Germans, however, could make no progress against the French artillery.

The most constant and severe fighting of the winter took place in the Argonne region, where the army of the Imperial Crown Prince established a line after its failure to capture Verdun. This was a densely wooded country, where artillery cannot be used to advantage, and the fighting was mostly of a hand-to-hand nature. Positions were frequently taken and lost, with no decisive advantage for either side until July 16, when the French recaptured most of the ground occupied by the Crown Prince, Hartmannsweilerkopf, a spur of the Vosges thrust out toward Mülhausen, was lost by the French on Jan. 19, and regained in the last days of March.

In October the French had begun sapping operations against the crest of a hill at Les Eparges, one of the most important positions of the St. Mihiel salient, for it commanded the entire Woëvre Valley. On Feb. 17 the first mine was exploded, and the first line of German trenches taken. The struggle for the hill continued almost incessantly until April 9, when with bayonets and machine guns the French gained the summit, and the Germans withdrew.

In the north, the British assumed the offensive on March 9, near the village of Neuve Chapelle, between the River Lys and La Bassée. Here their line was bent back in an awkward fashion. They dug their way almost to the German trenches and exploded mines. This attack was supported by heavy French artillery. By the 11th the village was in the hands of the British, and their line was straightened, being pushed forward a mile over a three-mile front.

On April 17 the British succeeded in gaining a height known as Hill No. 60 near Ypres, which caused the Germans to concentrate troops and artillery in the vicinity in expectation of further attacks. Then they themselves took the offensive on April 24, and the resulting engagement has received the name of the second Battle of Ypres. It is especially noteworthy for the fact that one of the new weapons of warfare used by the Germans was here employed for the first time. The advance was preceded by a thick cloud of asphyxiating gas, carried on a favoring wind. This novel weapon broke the Allies' lines; but after four days of severe fighting the German plan, which was to pierce the enemy's line by sheer force of numbers and heavy artillery, and open a way to Calais, ended in a gain of two miles over a five-mile front. The Canadian troops here received a grilling baptism of fire. One regiment, which held an advanced position, was almost annihilated by shot and gas.

The Battle of Richebourg-Festubert, some 20 miles to the south (May 9–24) marked a British advance of 600 yards over a front of 4 miles but their losses were appalling. Nothing less was required to drive home the fact that such wastage must continue so long as the British were inadequately supplied with ammunition and practically without high explosives, and it was not until Lloyd George was given sweeping authority as minister of munitions that the shortage was overcome. After this, the Germans, engaged in their great Russian operations, remained comparatively quiet. South of Béthune an offensive launched by Foch on May 8 netted moderate gains, among them the villages of Ablain, Carency, La Targette and a part of Souchez, all north of Arras. The French plan included the seizure of a remarkable steel-and-concrete fortification known as 'the Labyrinth,' covering nearly two square miles south of Neuville-St. Vaast, in the same district. After three weeks of desperate endeavor, on June 22 the French broke through 'the Labyrinth.' But the German line did not crumble nor did the so-called Battle of Artois compel Germany to lessen her pressure on the Russian front. In the last week of July the Germans employed flame projectors after a violent bombardment, and regained a line of trenches near Hooge, east of Ypres, which the British had taken a short time before; but on Aug. 9 lost them again together with 1,200 yards of their own trenches.

But, in the main, the summer was devoted to preparations for the autumn drive. This was a twofold operation with the coal city of Lens as its objective in the north and Vouziers in the Champagne sector. Preceded by the most violent bombardment thus far attempted, the French general, Pétain, sent over his troops west of the Argonne on Sept. 25, and by the early part of October had advanced on a front of about 15 miles for a depth averaging about 2.

In the north Foch attacked and seized the western slope of Vimy Ridge, but was halted at this point owing to reverses of the British. The latter had successfully stormed the Hohenzollern Redoubt, taken Loos, and still further penetrated the German lines. These unexpected gains caught the British Staff napping. The divisions rushed forward to consolidate the positions were recruits and inadequate in numbers. They could not stand their ground and Foch had to be appealed to for aid. In this struggle, known as the Battle of Loos, the British captured 3,000 prisoners but lost no less than 60,000 men. Though generally credited as a victory for Great Britain, it was actually a humiliating confession of weakness. A genuine Allied success in Artois and Champagne would have tended to check the invasion of Serbia, and might very well have eliminated the Noyon salient, its ultimate aim. In its favor may be cited the lessons it contained for the Allied Commands. It proved the prologue to the Battle of the Somme (q. v.). By the Germans it was viewed as a confirmation of British unpreparedness and in a large measure paved the way for the attack on Verdun (q. v.). That it sowed doubts in the mind of the British War Council is evidenced by the early retirement of Sir John French in favor of Sir Douglas Haig (Dec. 15).

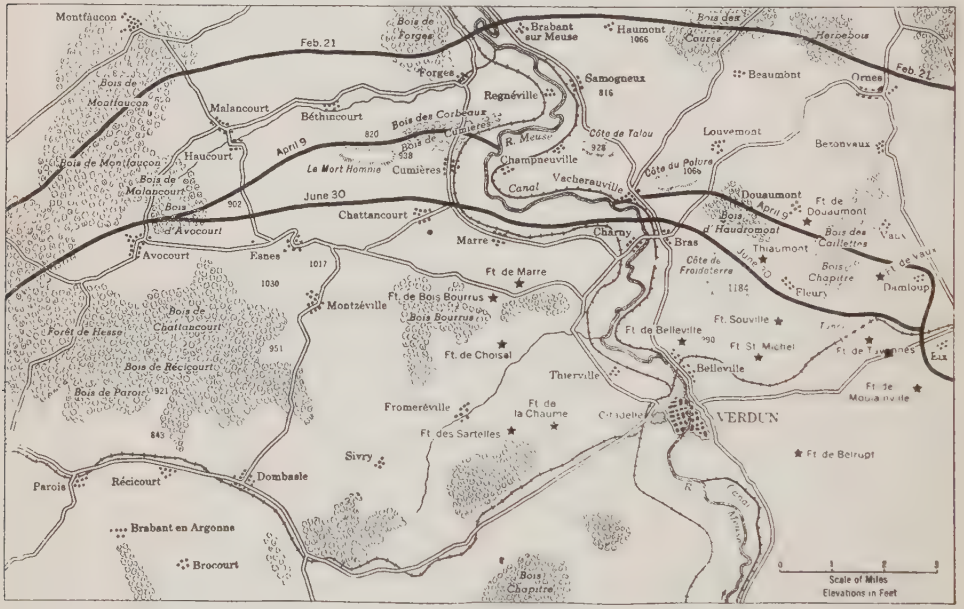
Battles of 1916.—By the

Military Service Act, Great Britain introduced conscription in January, 1916, thereby being able to find more troops for her various theatres of war and making up her losses on the Western Front, which had totaled 500,000 men to date. Great Britain, with a million soldiers in France, soon was able to hold 87 miles of the front line, the total length of which was 466 miles, and though this proportion of the whole frontage was small it comprised a relatively larger part of the strategic area. Numerically the Allies were somewhat stronger in France than the Germans at this time, and could their losses be kept below those of their enemy (and Russia be kept in the field), their prospects for ultimate victory were not visionary. Among the factors as yet unseen, however, were the appalling losses which were to bleed them white, and their absolute dependence upon a fresh supply of man power from America.

Verdun.—The citadel of Verdun had for years symbolized the power of France. Its capture would dishearten France incalculably and weaken her. It would furthermore afford a wedge between the French armies of the east and center and serve as the base for a fresh attack on Paris. If it did not compel France to accept a separate peace, it would probably force the British either to launch prematurely their anticipated drive against the Noyon salient or to reinforce the French at Verdun and thereby postpone it indefinitely. That the French alone could withstand such formidable pressure never entered German calculations. France not only discomfited her adversary; she astonished the world, at the same time creating for herself a reserve of self-confidence, of spiritual force, on which to draw till the end of the war. Verdun may well be acclaimed the epic of French military prowess. It meant more than that. To French fire and dash it added the more sober virtues of grit and tenacity, dispelling the illusion prevalent even among her friends that France was a decadent, perhaps even dying race. 'Ils ne passeront pas!' (They shall not pass) cried the poilus. The gesture was theatrical, but the body behind it offered itself as a barrier. When it was proven that the Germans could not pass, the Gallic spirit stood vindicated.

The preparations against Verdun were conducted on a scale surpassing all previous German offensives. Concentrated artillery fire was to annihilate not only the whole defensive system but the defenders as well. It was to have been a four-days' march through a desert, culminating in the surrender of the ruined city to the Crown Prince at the Place d'Armes. The Kaiser's heir was the nominal, Count von Haeseler of Antwerp fame, the actual commander of the five army corps carefully trained to finish up what the big guns might leave of the three divisions of French Territorials under General Herr. Everything had been planned with Prussian precision and staged for a success. That the *coup* was to end in a fiasco seemed incredible, and still does.

In the struggle for Verdun four phases are to be distinguished. Preceded by a fortnight of minor operations on several fronts as a blind for the true objective, the first begins with the bombardment of February 21, 1916; and includes the capture, with tremendous losses, of Haumont Wood (Feb. 21), the village of Haumont and Caures Wood (Feb. 22), Brabant, Samogneux, and Herbébois (Feb. 23), Beaumont (Feb. 24), and Fort Douaumont (Feb. 25), bringing the Germans forward four miles within full view of their objective. An attack of such violence had been entirely unlooked for by the French, and for a time the fate of France and



VERDUN.

The French fronts at the beginning of the First Battle of Verdun, Feb. 21, 1916, on April 9, and on June 30.

of the Allies hung in the balance. From a purely military standpoint it seemed folly to attempt to hold the east bank of the Meuse with the flooded river in the rear, but broader issues were involved, and General de Castelnau called upon Pétain to save the situation. Reserves were rushed from other sectors and on the night of Feb. 26 Balfourier's already famous Iron Division counter-attacked along the whole of Douaumont Ridge, successfully defended Haudromont, and swept the Germans from every position except the fort itself. With the enemy thus checked the first phase of the action ends.

The second phase is known to the French as the Battle of the Wings in that it covers operations in the Woëvre, to the east of the Heights of the Meuse, and also those on the west bank of the river, though including the no less bitter conflict raging at the center between Côte de Poivre (Pepper Ridge) and Fort de Vaux. In the Woëvre the advance was made in two major attacks through which the Germans won the villages of Dieppe, Abaucourt, Blanzée, and Manheulles (Feb. 29–March 4), and Fresnes to the extreme south (March 7). West of the Meuse, Forges was evacuated March 5, Bethincourt was threatened from the north (March 8–10), and the wooded slopes between Malancourt-Haucourt and Avocourt were subjected to a severe attack by artillery, liquid fire, and infantry in force. Malancourt finally was rushed on March 29, the Germans numbering fifty thousand, the French but one. The most violent fighting, however, was at the center, where the struggle for Fort Vaux and Le Mort Homme (Dead Man's Hill) raged with fierce violence until the evacuation of the latter by the French on May 31 and the capture of the former on June 6.

The battle now enters its third phase and centers for the rest of June around Thiaumont, which the Germans succeeded in capturing on June 22 only to lose it again on June 30. There were further German gains, slight but significant, during July and August, but Germany had her hands too full in the Somme to spare men and material. However, as it was, by September the Germans had reduced Thiaumont, occupied Fleury, were threatening Froide-Terre and closing in on Souville, the last fort barring the way to Verdun; but the final attack promised by the Crown Prince never materialized. Six months of steady hammering had not carried him forward as many miles. It brought about his temporary eclipse, for Verdun was registered as a colossal failure. It caused the retirement of von Haeseler, soon to be followed by that of von Falkenhayn as Chief of Staff.

The fourth and final phase of the struggle begins with Pétain's counter-offensive planned in September, 1916, whereby the French defenders under Nivelle recaptured, on Oct. 24, the fort and village of Douaumont, the Thiaumont field work, Hardaumont, and Caillette Wood and, on Nov. 1, Fort Vaux itself. It continues with the re-establishment of the French, on Dec. 15, at Vacherauville (on the Meuse), Pepper Ridge, Louvemont, Bezonvaux, and the remainder of the Hardaumont defenses. Of all Germany's hard-won gains she now retained little of importance on the east side of the Meuse.

Regarded in its exact chronological relation to the progress of the war as a whole, Pétain's counter-offensive belongs to a period later than that under discussion, but, viewed as part of the great Verdun drama, no stage of it can be separated with propriety from the whole. The final stage occurred during the summer of 1917. At the instance of Pétain, now Commander-in-Chief of all the French Armies, the attack was resumed on the west of the Meuse. Preceded by a violent struggle in Avocourt Wood (June 29), the French advance began on July 1. By the third day most of the first and second line trenches had fallen into their hands. After a check, followed by a considerable lull, the thrust was continued on August 20. The Germans were driven out of the Woods of Avocourt, Cumières and Corbeaux and from Le Mort Homme. By August 26, Hill 304 had been captured, too, and the Germans forced back to lines approximating those of Feb. 21, 1916.

France had frustrated Germany's intent, but at an awful price in human lives. The 1916–17 battles at Verdun were the only ones on a major scale on the Western Front where the losses of the attackers were less than those of the defenders. Whereas 281,000 Germans had fallen, no fewer than 315,000 Frenchmen had died to ensure that the Allied line should not be broken. Those Allied leaders who knew that their powers of recuperation were dwindling at a rate faster than those of their enemy's, realized with sinking hearts that perhaps they had scored but a Pyrrhic victory, for two years and more of fighting had brought ultimate success no nearer. (See VERDUN).

Battle of the Somme.—In July, 1915, the British had taken over a large part of the line from Arras to the Somme; the winter had been comparatively quiet, the Germans taking advantage of the lull to convert their positions into what amounted to a continuous series of fortresses. Joffre having refused Haig's offer of support at Verdun, assistance was lent by relieving Foch in the sector opposite Souchez and Lorette. The British forces were now disposed as follows: Plumer's Second Army before Ypres, Monro's First Army opposite Neuve Chapelle, Allenby's Third Army covering the former French front, and Rawlinson's Fourth Army with its right near the Somme. Meanwhile, there had been a number of conflicts at various points, serious mainly because of the loss of life entailed. The earliest occurred in the Ypres sector, south of Hill 60, and ended with the repulse of the Germans on March 2 (1916). This incident was notable because it marked the first engagement in which British infantry employed helmets. For ten weeks, beginning with the end of February, Loos was the scene of continual mining and countermining, which cost the British alone some 4,000 men. Especially severe fighting took place around the Mount near St. Eloi. This was captured by the Canadians on March 27 and defended against vigorous counter-attacks on April 6–9 and April 19, the casualties for the Canadians averaging a thousand a week. Among other local engagements were those on Vimy Ridge (May 15 and 21); at Wulverghem, west of Messines (April 30), and at Mont Sorel on June 2 when the Germans captured 14 officers, including a general. This assault threatened Ypres, and it was June 18 before the lost trenches were regained. The seesaw cost the Canadians about 7,000 men. Most of the German attacks had been launched as feelers. That they were aware of an impending drive was gleaned from prisoners taken in the 70 raids made in the week preceding it. The hour for that drive struck when the Austrians were checked in the Trentino and driven from Bukowina.

An Allied attack was to be made in successive stages against defenses previously demolished by artillery, each stage to be undertaken by fresh units. The tactics were essentially those employed against Verdun save that the pressure was to be unremitting. Thus was this outlying frontier of Germany to be penetrated, Teuton reserves detached from the battering-ram on the

Meuse, and Russia and Italy given free rein against Austria. Among other objects, to quote General Haig, it was to wear down the strength of the forces opposed to the Allies. The British army of assault comprised General Rawlinson's five corps and one corps of General Allenby's to the north and extended about twenty miles from south of Gommecourt, down across the Ancre Valley to Fricourt, thence eastward almost to Maricourt. From there, for another eight miles to opposite the village of Fay, were massed the three corps of the French Sixth Army under Fayolle. Opposed to the Allies was the right wing of the German Second Army under Otto von Below, some eight divisions from various corps. Thus at the outset the Allies numbered, roughly 350,000 men as against less than half as many Germans. During the development of the struggle, the personnel of the German command underwent several modifications and supreme authority was invested in the Crown Prince of Bavaria, leader of the Sixth Army; the old First Army was revived and placed under von Below, the Second going to von Gallwitz; new units were established and the forces were very largely increased.

Bombardment from Flanders south began after the middle of June; by June 24 it became intenser, and the weather was overcast and rainy. Next day the airplanes operated in force, bringing down nine of the enemy's observation balloons, and maintained their command of the air. On June 30 it cleared, and the attack was set for three hours after the following dawn. That morning, Saturday, July 1, 1916, the artillery-fire increased in fury; at 7:15 the range was lengthened, and fifteen minutes later, behind its curtain, the Allied infantry went over the top.

Thus began the Battle of the Somme, which lasted until Nov. 18, 1916, constituting a series of limited engagements. The British infantry, so weighed down by equipment that they could proceed with difficulty only at a slow walk, were mown down in swathes before they could reach the enemy's lines (which the artillery had failed to demolish). By noon on the first day 60,000 of the flower of Britain's new citizen army had died in vain because (in the words of the *Official History*) 'the problems of semi-siege warfare and the large concentration of guns necessary for the attack of great field defenses had never been studied in peace-time by the General Staff.' After twenty weeks of warfare waged within the enemy's lines, Haig stated that 'the enemy's power has not yet been broken, but the Somme battle has placed beyond doubt the ability of the Allies to gain their objects.' In reality, again to quote the British *Official History*, 'captures of prisoners, but not the heavy casualties, were regularly reported,' the military leaders deliberately keeping the true state of affairs from the public and the politicians at home.

The onset of rains in the autumn slowed down the painful efforts at advance which continued to be made, and the deep mud finally brought all operations to a standstill. The reckoning in human life was: British, 420,000; French, 194,000; and German, 440,000. At a cost of one million dead, some forty French villages dotted over 200 square miles were blotted out—and the course of the World War had yet two years to run. (See SOMME, BATTLES OF).

Third Year on the Western Front.—The opening of 1917 found General Haig, now Marshal, still in supreme authority over the British forces in France, while General Joffre, previously elevated to the same rank, was acting as head of the Allied Military Council, his command resigned to General Nivelle (Dec. 15, 1916), hero of the recent Verdun offensive. Pétain had apparently been passed over. Such was not the case; he had refused to accept the position unless freer hand were given to its incumbent. Lack of co-ordination between even the French units and certainly more or less friction between the Staffs of Great Britain and France was one of the main handicaps against a successful conclusion; and this was fully recognized by Pétain, the unerring strategist. The military dispositions of Germany, directed by von Hindenburg, Chief of Staff and virtual dictator of all the Teutonic forces since September, remained unaltered. Duke Albrecht of Würtemberg commanded the northern sector; Crown Prince Rupprecht of Bavaria the central, including the Somme; and the Imperial Crown Prince the sector of his stumbling block, Verdun, which included the Aisne and Champagne fronts. The German forces were favored by their unity of command, for the royal leaders were but puppets played upon by von Hindenburg and von Ludendorff, the First Quartermaster-General.

The Anglo-French front in the Somme presented the same contours as it did in November. Before Verdun the French gains of Oct. 24 and Dec. 15 had been consolidated, but no changes had developed.

The western campaign of 1916 had ended in a military stalemate. Politically all of Europe was in flux. The German peace proposals of December had been rebuffed but the *régimes*, both civil and military, of all the belligerents, especially the Allies, dared no longer impose their will without national approval. Propaganda had begun to play as important a part as the shell. Though the Irish Rebellion (see DUBLIN) had been put down, Great Britain's authority was being attacked or undermined in other quarters. Her hold on India was none too secure. In England pacifism was raising its head; in France defeatism was being sedulously fostered; in Italy anti-Entente socialism and pro-German capitalism were operating side by side; in Russia Bolshevism was about to break loose. The party of genuine patriotism was on trial, as it were, in all those countries. The Allied rejection of the German peace proposals were accompanied by the statement: 'The Allied nations have sustained for thirty months a war they did everything to avoid. . . . Once again the Allies declare that no peace is possible so long as they have not secured reparation for violated rights and liberties, the recognition of the principle of nationality and of the free existence of small States.'

On Jan. 9 the British began to renew their activities at the exact point where they had ceased, the Ancre, making gains near Beaumont Hamel and later north of Beaucourt. On Feb. 7 they took Grandcourt, and, after a fortnight's hard fighting, Serre and the two Miraumonts. Without warning the advance was made easy. For the first time since their occupation of the Somme, the Germans abandoned their positions. By Feb. 25 a retirement was in progress to their main fourth line, the extension of that eastern system of defenses which had proved unattainable to the British center in the autumn. The British at their heels, they had 'rectified' their line on a fifteen-mile front. Two days later Haig's men were converging on Bapaume and pressing towards Achiet-le-Grand, the junction of the railway to Arras. On March 4, as President Wilson of the United States was entering upon his second and epoch-making term, Great Britain took over the southern sector of the Somme, so that her front now extended from behind St. Quentin to north of Ypres and then beyond the Belgian Army to the sea. This relieved France

from what had seemed too large a share of the pressure. The French Sixth Army (Fayolle) was released for service against the Chemin-des-Dames. The Germans had already put out feelers between Soissons and Rheims on Jan. 30. The Allied strategy, as they undoubtedly guessed, would not vary largely, save in intensity, from the experiment of 1915, namely, drives from the west and south against the Noyon salient. Confirmation of this was obviously the object of the raids of Feb. 15 near Maison de Champagne.

That a tremendous offensive was due von Hindenburg was certain. Prevent it he could not; postpone it he might, and probably hamper its full effectiveness by the counter-strategy he was about to develop. Unquestionably he seemed to have stolen the Allies' thunder when his whole army began to fall back on a line from north of Cambrai to east of Noyon, but as certainly did they recover their powers of lightning initiative. Nor did this 'strategic retirement' take place with all of the smoothness anticipated. Caused primarily by the Anglo-French successes on the Somme, it was forced prematurely by the present British pressure on the Ancre. Beginning on March 17 with the abandonment of a sixty-mile front between Bapaume, which was immediately occupied by the British, through Roye to Lassigny, recovered by the French, the Germans withdrew the next day on a line from Arras to Soissons, giving up Péronne, Chaulnes, Nesle, and Noyon. To the north the British were now forced to slow up, the Germans having reached their destination, the formidable barrier of the Hindenburg line. To the south the movement did not cease, the old line having bulged much farther west in this quarter. On March 19 the French were in the ruins of Ham, Guiscard, and Chauny; and, gaining momentum, followed the enemy somewhat closer and farther than was expected, far enough also to see Coucy-le-Château, another of their historic monuments, being wantonly destroyed. On March 21 the Germans halted, making what was intended to be a conclusive stand on the Arras-Cambrai-St. Quentin-La Fère line.

During their retirement the Germans had systematically devastated an area of over a thousand square miles. Three hundred towns and villages were wiped out; the fate of Coucy-le-Château was accorded to every edifice precious to the history of France, church and castle alike; not a farmhouse was left standing; orchards were levelled; wells were polluted. Though all of the railroads had been destroyed, new ones were being laid with remarkable speed. Guns were rushed forward by manpower if other means were lacking.

By March 20, 1917, the French were near enough to La Fère to impair its value as a base. The capture of two of its forts further weakened the German position. Still farther south the French forced the Ailette River (March 22) and reached the edge of Coucy Forest, but here they were compelled to pause. Towards St. Quentin they were more successful. Forcing the Somme Canal, they threw the Germans back on the Oise to Moy (April 4) and began working up from the south to the rear of the city. The British, in the meantime, were sweeping on to its north, having taken Roisel (March 24) and Vermand (March 31). On April 1 they were in Savy 4 miles s.w. of St. Quentin and by April 5 commanded it from the north as well. The city was at the mercy of the Allied artillery; but it was a French city; that, as ever, was the handicap.

Farther north raged the Battle of Arras (q. v.), whose objectives as ever were Lens and Cambrai. Here the British were delivering violent attacks against the Germans covering the Scheldt, or Escaut, as it is called in Northern France. The headwaters of this river are canalized, as are so many of the riverlets of France, which are linked with one another by a system of true canals. Thus the rivers Yser, Lys, Scarpe, Somme, Escaut, Oise, and Aisne are interconnected. These waterways, extending from Flanders to Champagne, were a valuable accessory to railway transport. Their control was the object of many a fierce engagement; their defenses always formidable, their defense correspondingly stubborn.

The Escaut Canal between Cambrai and St. Quentin was made useless by the British occupation of Epéhy on April 1. While the pressure south of Arras was at its height, the whole German front from St. Quentin to Lens was subjected to a prolonged hurricane fire which gradually intensified north of the Scarpe. Here, April 9, an attack centering on Vimy Ridge was launched on a 12-mile front. By the fury of this assault the Germans were driven back several miles and the famous ridge, long deemed impregnable, was stormed and practically cleared by the Canadians. On their right the British made progress along the Scarpe, capturing the next day Fampoux and the enemy positions astride the river, and on April 11 Monchy-le-Preux, with the heights commanding the region towards Cambrai. On April 12 the Germans were ousted from their last foothold on Vimy Ridge and the village of Vimy, while the next day their right lost Angres, a southwesterly suburb of Lens. Soon the British were in Lieven, its very outskirts, and pressing in on Avion to its south. The little Souchez was running red and the collieries were slowly changing color. Before long the fight was being carried into the coal city itself. Persistent pressure against their line through Oppy was driving the Germans back towards their emergency line running from Drocourt to Quéant. They were already strengthening their positions to the rear of the Hindenburg line, whose value had been decidedly diminished. Below Havrincourt Wood they drove a great wedge towards Cambrai, cut the railway running to St. Quentin via Epéhy, and took Villers-Guislain (April 18). The capture of this village brought the British within almost 10 miles of Cambrai.

While the British were making these successes in the north, the French launched their own big offensive between Soissons and Rheims (April 16). On the first day of this Second Battle of the Aisne (q. v.) they smashed the German first line on a front of 25 miles and penetrated their second line in several points. The advance on Craonne was well under way, and special success had been achieved by the right operating against Juvincourt. The second day was spent in consolidating the gains; on the third almost all of the second line was seized, together with Condé-sur-Aisne, Ostel, and the town of Vailly, all three across the river. At the same time pressure was being brought to bear all along the Champagne front east of Rheims. Though primarily a holding movement, it succeeded in breaching the German front from Prunay to Aubérive-sur-Suippes, a width of 11 miles, and secured the heights south of Moronvilliers. Three days later the offensive was resumed on the Aisne. A tremendous drive was made across the Chemin-des-Dames between that river and the little Ailette. At this juncture the Crown Prince began throwing his reserves into the conflict and progress became slower, but in spite of stubborn opposition May 5 found the French advancing astride the Soissons-Laon road and in Craonne, whose ridge they

were struggling to clear. Next day the French were making still further progress across the Chemin-des-Dames ridge, heavy German counter-attacks proving unavailing. The struggle fluctuated for the rest of the month.

Meanwhile the British were gaining ground along the Scarpe and the Sensée to its south, and giving their attention to Havrincourt Wood, due east of Bapaume. The woods, as in the Battle of the Somme, remained the chief obstacle to a uniform advance. Elimination by containment was generally the final solution of their menace. In Havrincourt Wood the British secured a foothold on April 23. May 12 found the more northerly units well along the Arras-Cambrai road and battling for Bullecourt close to the railway below it. This village was finally cleared on May 15 and the drive towards Quéant resumed. By May 21 all of the Siegfried Line except a section on the Bullecourt ridge was in British hands. There was a lull as the field of major operations suddenly shifted 50 miles to the north.

As a prelude to the Battle of Flanders an attack was delivered (June 7, 1917) on the front between Armentières and Ypres. Its aim was the destruction of the Messines-Wytschaete salient. For fully a year the Anzacs had been busily engaged in mining the ridges under these two villages. The detonation which accompanied the earthquake that destroyed them both (June 7, 3 A.M.) was audible 140 miles away across the English Channel. Resistance was all but paralyzed. Before nightfall Plumer's army was in possession of what there was left of Messines Ridge and the wreckage of its villages. Strenuous counter-attacks proved ineffectual. On the extreme British left, on the other hand, a German counter-offensive met with more success (July 10). The French took over this sector which was flanked by the North Sea. The *contretemps* in no way disarranged the scheme of the Allied advance from Ypres south.

The French, in the meantime, had been making moderate gains on the heights east of Rheims and were holding their own against the Germans on the Chemin-des-Dames. The failure of Nivelle's great offensive between Soissons and Auberive on April 16 was but the culmination of a series of attacks which had cost the French immense losses without commensurate results, and at length large sections of the army mutinied. No less than 16 army corps were affected, and the menace which threatened to immobilize the whole army was removed only when Nivelle was replaced by Pétain as commander-in-chief on May 15, 1917. The Germans began on July 19 a series of tremendous blows against the Craonne positions and then on July 28 against those in Champagne west of Moronvilliers. Between the California and Casemates ridges they were temporarily successful, but the result of the drive as a whole was mere wastage of German lives. Since April 16 the Crown Prince had thrown over a million men into his effort to stem the French tide and had recovered no ground worth mentioning.

In the Lens sector, the British had been at work pocketing the city. Thrusting northeast from Vimy Ridge, by June 28 they were in Avion, the southern suburb. Their rear was protected by further gains beyond Oppy well to the south. There was another long lull followed by a supreme effort from the north. A vigorous attack on Aug. 15 secured all of the northern defenses, including the famous Hill 70, an altar on which thousands of lives had been sacrificed.

Meanwhile the Battle of Flanders was in full swing. It began on July 31 with a Franco-British attack on a 15-mile front from the Lys up to the flooded area opposite Nordschoote. In a single day the French, forming the left wing, captured the hamlet of Steenstraat and village of Bixschoote; and the British, east of the Ypres-Staden Railway, Pilckem, St. Julien, Westhoek, Hollebeke, Basseville, in all ten villages and hamlets. The French continued to gain on the Yser, while St. Julien was lost to a German counter-attack (Aug. 1), but recovered two days later. Then followed a period in which the gains were consolidated and the enemy cleared from Westhoek ridge and a foothold gained in 'Glencorse' Wood. On Aug. 15 came the second general assault. The second day found the British in Langemarck. They advanced still further on the Ypres-Menin road (Aug. 22) but lost ground before a counter-attack two days later. Operations were temporarily suspended at the same time as they languished before Lens after a moderate success by the Canadians (Aug. 21–23).

Just before this Pétain had carried off his coup before Verdun and in one day (Aug. 20, 1917) had recovered all of the strongholds between Avocourt and Bezonvaux, including the Avocourt Wood, Le Mort Homme, the Corbeaux, and Cumières Woods on the west bank of the Meuse and the Côte de Talou and Champneuville on the east. The next day France had driven the invaders from their trenches between Cumières and Hill 240 and cleared the Côte de l'Oie and Regnéville, with Samogneux on the other bank. By the 26th the famous Hill 304 was at last regained.

In other sectors comparative quiet reigned though the British were becoming more active near St. Quentin (Aug. 26). The French still repulsed the Germans in Champagne, while on the Chemin-des-Dames the struggle fluctuated, the initiative, if any, resting with France.

Passchendaele.—Near the coast the British were preparing for the third phase of the Battle of Flanders. Haig appeared now to have Ostend and Zeebrugge, the submarine base, as his final goal in this quarter. The immediate objectives were control of the Ypres-Menin road and Passchendaele Ridge. The offensive began on Sept. 20, 1917, on an 8-mile front between the Ypres-Comines Canal and the Ypres-Staden Railway. The tactics employed have been indicated with more or less detail in the Battle of the Somme. A present variation was the increasing use of tanks and the occupation in the attack, as well as the defense, of shell-craters created for that purpose during the final moments of the barrage. By the end of Sept. 20 the British were masters of Veldhoek, of the Glencorse Wood and several others clustering about this point.

The drive was resumed on Sept. 26, the Australians finally clearing the difficult 'Polygon Wood,' and the British taking Zonnebeke, a mile beyond. The objectives of the right and left were also attained, and the British were now well up on the slopes of Passchendaele Ridge, where they held their positions against seven counter-attacks.

The fifth stage of the offensive began on Oct. 4 on a front of 8 miles. It won the main ridge to about a half mile of Broodseynde; but bad weather stopped the operations for a while. With the French supporting his left, Haig inaugurated a sixth attack (Oct. 9) on a 10-mile front. The British advanced a mile and a half to a point beyond Poelcappelle, while the French captured Veldhoek (not to be confused with the southern hamlet taken on Sept. 20) and Mangelaere. The British were now within a few hundred yards of the village of Passchendaele, they commanded the plain of Flanders, and were within gun range of Roulers.

The next general attack came on Oct. 12. An advance was made on a 6-mile front, mainly along the Ypres-Roulers road and the railway. The Forest of Houthulst threatened the British left. The French gained a foothold in it and ground to its northwest. Resuming the assault ten days later, the British made progress on the railway, while the French cleared the southern part of the big forest. For two days beginning Oct. 26 the Allies attacked again, the French, astride the Bixschoote-Dixmude road, taking Merckem and four other villages and clearing a number of fortified farms and groves, while the British were gradually enveloping Passchendaele. Another attack (Oct. 28) gave the French, with the Belgians on their left, the elevation of the Merckem peninsula. Two days later the British, with the Canadians serving as shock troops, carried the line before Passchendaele. From this they were forced to retire before overwhelming odds, but repulsed with great loss the numerous counter-attacks directed against their former positions. After a week of intense artillery fire Passchendaele was stormed again on Nov. 6. The Germans were ejected from their positions and driven back to defenses half a mile beyond. For another week there were repeated counter-attacks, all of them unavailing. Operations in this sector now petered out, brought to a halt by unceasing rain, which had waterlogged the entire country side. Haig had pledged himself to the Cabinet that he would not incur 'heavy losses;' the cost had been 400,000 lives to secure what once had been the village of Passchendaele.

Meanwhile Pétain had been delivering another heavy blow east of Soissons. Before the third week of October he had been subjecting the German positions south of the Ailette to a very searching and destructive fire. On Oct. 28 French troops cut their way in for 2 miles on a front of 6, cleaned out Fort de la Malmaison on the center and Vaudesson and Allemant on their left. The assault was materially assisted by squadrons of the new small French tanks. German counter-strokes by a number of shock divisions held in reserve for the purpose were completely shattered, mainly by the artillery, before they were given a chance to materialize.

The Germans were driven out of Pinon and Pargny-Filain (Oct. 25) and were compelled to fall back on the Ailette, and over a hundred of their big guns were abandoned. Their Chemin positions now practically untenable, they gave up their last hold on the western ridge of the Chemin-des-Dames and began a hurried retirement behind the river on a 12-mile front. This released a number of towns to the east—Cerny-en-Laonnois, Courtecon, and Ailles—and thereby enabled the French to link up their new gains with those in Craonne. By Nov. 3 the whole plateau south of the Ailette from Corbeny to the Oise Canal had been left behind. Thus ended the operation which amputated the German elbow of Laon.

Unity of Command.—At this crucial point the whole plan of the Allied campaign was dislocated by the fierce Austro-German attack on Italy. As the first Americans of the Expeditionary Force were receiving their baptism by fire, the German troops set free by Russia's defection were invading the Venetian Plain. It became imperative to lend assistance with all possible speed lest a situation should arise whereby France would be threatened in the rear and the Mediterranean be opened to Germany. Accordingly Franco-British forces were detached from the Western front, and on Nov. 3, 1917, as the first American regulars fought in France, a British army under Plumer and a French under Fayolle appeared in Italy and prepared to defend the Adige. After the Caporetto disaster on the Italian front, November 5–8, the Allies realized as never before the need of closer co-operation. In the Italian war zone itself Great Britain, France, and Italy called a conference which named a permanent Inter-Allied Military Committee made to include Generals Wilson, Foch, and Cadorna. It was high time that this step was taken by the Entente. All of its major parties were present, the absent partner, Russia, having on the same day (Nov. 8) been betrayed a second time, on this occasion not by Tsarism but by Bolshevism.

Cambrai.—While the great struggle in Italy occupied the arena, and the world audience wondered whether there was not about to take place another autumn land-clearing such as had overrun Serbia in 1915 and Roumania in 1916, there was a lull on most of the front from Alsace to Flanders, a lull broken on Nov. 20 by a resumption of the British drive southeast of Arras. This series of operations gained the name of the Battle of Cambrai (q. v.), from its objective. Prefaced by an artillery feint on the Flemish front, an attack was launched by Byng's Third Army on a line extending roughly from Quéant to Gouzeaucourt, possibly 15 miles. No long-drawn-out bombardment gave warning to the Germans. The assault seems to have been a genuine surprise. Supported by a large number of tanks with wire-cutting devices, the British were able to advance for two days without serious check. In that brief time they broke through the Hindenburg Line, occupied Moeuvres, Havrincourt, Gonnelieu, La Vacquerie, Graincourt, Anneux, Marcoing, Masnières, and other villages, and cleared all the farms and ridges of the occupied area. Nothing like it had occurred on the Western front. At the close of the second day their line was shaped something like an inverted U about 30 miles in extent, the center of it resting on Cantaing, less than three miles from Cambrai. Following a hasty consolidation of positions, from Nov. 24 to 26 there was a fierce struggle over Bourlon and its wood, the former exchanging hands four times. Though it was recovered by the Germans, the British established a footing in the wood and an unsuccessful effort was made to flank it from Fontaine-Notre-Dame, which they captured but had to relinquish, themselves menaced from the southeast.

Without preliminary shell-fire the Germans quietly launched a counter-offensive (Nov. 29–30). The assault or assaults, rather, were delivered against both ends of the inverted U and threatened, if successful, to hem in the British center. It was the British turn to be surprised as on their right the Germans penetrated their line south of Villers-Guislain and, by a turning movement to the west, then north, enveloped La Vacquerie, Gonnelieu, and two other vital positions. To the north the German movement was directed between Moeuvres and Bourlon Wood, but here it was met with resistance. However, at best, Byng found himself in awkward straits. It was generally known that the Germans were being reinforced by their old eastern divisions, and there was a strong possibility that he might be bottled up unless he shortened his line. As it was, many British units had been cut off, though a number of these eventually worked their way back, so loosely were the lines held by either side. For a change the two commands were playing for position. During the interim many fierce German attacks were repelled, but Byng decided to play safe and on Dec. 2, 1917, gave up Masnières on his right and on the 5th reluctantly withdrew from Bourlon Wood on his left. A general

retirement was made to positions forming a smaller salient which covered Moeuvres, left Graincourt for the Germans to occupy, and swung past lost La Vacquerie to link up with the old front on the right. As the net result of this fortnight's seesaw the British lost more than half of what had promised to be a very substantial and valuable gain. This checkmate added further to the general gloom.

United States Goes to War. —From the very beginning of the war there was a strong sympathy in the United States for the Allies, and not a few American leaders, notably former President Theodore Roosevelt, were outspoken in their denunciation of 'Prussianism' and demanded resolute action. On the other hand, the violated neutrality of Belgium had not been guaranteed by the United States; its infringement was no concern of theirs.

The Government remained silent and neutral, but the brave fight set up by the small Belgian army against the mighty German avalanche fired the imagination of many Americans, to which must be added the effects of the elaborated 'atrocity' stories emanating from both belligerent sides. The great Belgian relief measures so ably directed by Herbert C. Hoover (q. v.) reflected something more than generosity towards an oppressed people. The destruction of Louvain (q. v.) and other acts of terrorism antagonized American ideals. Officially the country remained neutral, unbiased, but the aid lent the Allies in the way of munitions and other supplies was not entirely mercenary. As if in anticipation of Château-Thierry, the first Allied victory on the Marne was hailed as if an American achievement, while the mutilation of Rheims Cathedral was lamented as a personal loss.

With the beginning of 1915 it became apparent that Teutonic plots were being hatched on both sides of the Canadian border. Then came the German proclamation (Feb. 4) establishing a war zone (q. v.) about the British Isles. Neutral shipping was directed to use certain defined routes outside this area. This breach of international law was at once protested by President Wilson, who announced that he would hold Germany to 'a strict accountability' for any loss of American life or property. The German reply was evasive; the whole incident stirred American resentment. The German measure became operative on Feb. 18, 1915. That day the *Evelyn* was sunk by a mine; on Feb. 23 the same fate overtook the *Carib*. Concessions offered by Germany on March 4 hinged on counter-concessions by the Allies and therefore led nowhere, while early in March friction was increased by the sinking of the *William P. Frye*, one of the victims of the *Prince Eitel Friedrich*. A bill of damage was presented. On top of this came the loss of the British passenger ship *Falaba* (March 28), costing one American his life. This sinking was the act of a submarine as was that of the *Gulflight* on May 1. The torpedoing of the *Lusitania* (q. v.) with her tragic losses, including over a hundred Americans, men, women, and children, alienated the real America completely. This act occurred on May 7, 1915. Germany's 'heartfelt sympathy' was ignored. There followed a long interchange of notes which reached a deadlock on Nov. 25 and a quasi-settlement on Feb. 15–17, 1916. The *Frye* case, it was agreed (Oct. 18), should be arbitrated by the Hague Tribunal. Meanwhile the *Nebraskan* had been attacked (May 26), the *Armenian* sunk (June 28), and two Americans lost on the liner *Arabic* (Aug. 19), while the *Ancona* had been sunk by an Austrian submarine (Nov. 9).

Ere this the scruples of William Jennings Bryan (q. v.) against signing the second *Lusitania* note (June 10, 1915), had led to his resignation, and a somewhat more vigorous policy was initiated under Secretary of State Lansing. During this period the agents of the Central Powers had not been idle. Strikes were organized in the munitions plants, factories set on fire, and bombs introduced in munitions ships. All of these plots were more or less directed by the Embassies of Germany and Austria-Hungary, the headquarters of an intricate system of propaganda, espionage, sedition, and arson. Eventually the admission of Dr. Constantine Dumba, Austrian ambassador to the United States, that he had given a letter to James J. F. Archibald, American war correspondent, to be delivered to Vienna, in which he proposed to cripple munitions plants in the United States, led to the recall of Dr. Dumba (Sept. 28), while in December the German naval and military *attachés*, Captains Boy-Ed and Von Papen, became *personæ non gratæ* by reason of pronounced anti-Entente activities.

The news in October of the execution (Oct. 12, 1915) of Edith Cavell, an English nurse in Brussels, charged with aiding the escape of British, French, and Belgian soldiers to join the Allied armies, was but another affront to American opinion, while the heroic stand of the French before Verdun, the following February, roused the admiration of most Americans. In the same month the revival of submarine warfare was threatened. To meet it the more pacific leaders of Congress urged the passage of the McLemore resolution, which called for the virtual abandonment of American rights as to travelling the sea. The resolution was tabled on March 7, 1916; on March 24 the *Sussex*, a British channel steamer, was torpedoed without warning and two more Americans were lost. President Wilson now threatened to sever diplomatic relations (April 18), in reply to which Germany promised (May 5) to use more moderation; but as before there were conditions attached. A further exchange of notes ensued as America's policy of 'watchful waiting' was resumed, but now with thinly veiled impatience.

Late in July, 1916, came the report of Captain Fryatt's tragic end (he had been executed for attempting to ram a German submarine)—still another incitement to American wrath, which was not appeased by the daring of the *Moewe* or the sportsmanship of the merchant submarine *Deutschland*. Germany, as sure as she was that the United States was either too timid or too devoted to her money-making to think of rupture, was following a dangerous course. Be that as it may, excitement over the novelty of the *U-53's* visit to Newport (Oct. 7, 1916) was turned to anger when six vessels (two of them neutral) were sunk a day later off the Nantucket Shoals. The action of this underwater courier was construed as a covert threat, and the subsequent treatment of Roumania tended to crystallize anti-German sentiment. Meanwhile the sinking of Allied ships continued with that of the *Colombian* (Nov. 8), *Chemung* (Nov. 28), *Marina* (Oct. 28), and the liner *Arabia* (Nov. 6), the last two with loss of American lives.

Shortly after this Germany launched a peace offensive with a note addressed to the Allies, Dec. 12, 1916. Her overtures were rejected, however, as 'empty and insincere' (Dec. 30), and America's good offices as intermediary were somewhat undermined by her manifest disapproval of the Belgian deportations. But Germany persisted in her policy of 'frightfulness' both by land and sea, evidently laboring under the impression that it would help to keep the United States out of the war.

While President Wilson was

Signal Corps Photo, U. S. Army

FRENCH TANKS MOVING TO THE SUPPORT OF FRENCH TROOPS NEAR JUVIGNY, FRANCE, AUGUST, 1918. TANKS PLAYED AN INCREASINGLY IMPORTANT ROLE AS THE WAR DEVELOPED. THEIR DEMONSTRATED VALUE PREPARED THE WAY FOR NEW MECHANIZED UNITS IN THE WAR OF 1939

Signal Corps Photo, U. S. Army

MEMBERS OF THE 132ND REGIMENT INFANTRY, 33RD DIVISION, OBSERVING ENEMY MOVEMENTS FROM CAMOUFLAGED FRONT-LINE TRENCHES ALONG THE MEUSE RIVER, OCTOBER, 1918

expressing before the Senate (Jan. 22, 1917) the principles of what was later to become the League of Nations, Germany was preparing a drastic blow against shipping. On Jan. 31 she announced that from Feb. 1 the larger part of the North Sea and Mediterranean and the Bay of Biscay were barred to shipping.—'All ships met within that zone will be sunk.' One American passenger steamer per week would be permitted to go to England under conditions no free nation could accept (see WAR ZONE). America promptly severed diplomatic relations, recalled her Ambassador, and dismissed the German Ambassador Von Bernstorff. On Feb. 12 Secretary of State Lansing declared to Germany, through the Swiss Minister, that only by the renewal of her pledges of May 5, 1916, was further discussion of the submarine question possible. The sinkings continued, and on Feb. 28 the final bomb was exploded by the publication of a dispatch from the German Foreign Minister Zimmerman to his Minister in Mexico, instructing him to propose an alliance with Mexico and Japan against the United States in which Mexico's bribe was to be Texas, New Mexico, and Arizona. Feeling ran high and American sensibilities were further incensed by the wanton German destruction of the evacuated districts in France during their strategic retirement.

The country was on edge and, on April 2, 1917, in his address before Congress, President Wilson unhesitatingly urged a declaration of war against 'this natural foe to liberty.' Two days later the Senate seconded the Chief Executive; and on April 6 the House by an overwhelming vote confirmed the resolution that 'a state of war between the United States and the Imperial German Government, which has thus been thrust upon the United States, is hereby formally declared.' Thus did the United States enlist in the great conflict.

In the early stages of the war the Allied Cabinets were disposed to view American neutrality as more advantageous than her active participation on their side. As a rich and generous friend, she was of more service than as an unprepared Ally. By the late fall of 1916, however, it became a question if America might not be needed to end the stalemate. As the revolution broke out in Russia and a democratic government was promised there, it seemed evident that with America's aid Germany would soon be crushed. With the spreading of disorder in Russia it became certain that without America, Germany might win.

Fortunately for the weakened Allies, America threw herself into the great task immediately and whole-heartedly. Immense appropriations were granted by Congress. The War Department took steps to bring the regular army up to war strength and the National Guard up to 330,000. Preparations were made for floating a great national loan. On April 21 a British Commission under Balfour arrived, followed three days later by the French War Commission of which Marshal Joffre was a member. Financial support was at once given to Great Britain, France, and the various Allies. Their economic relief was discussed and armed co-operation both by land and by sea guaranteed. On May 17 the Army Draft Bill was passed (see CONSCRIPTION), and as it was being signed next day by the President the first contingent of the Army, a unit of the Medical corps, reached England. On June 7 about 10,000,000 men of military age registered for compulsory service under the Selective Draft Law. General John Joseph Pershing was appointed Commander-in-chief of the American Expeditionary Forces, arriving in Paris with his staff on June 13. On the plea of the French and British Commissions it had been decided to hearten France by sending at once an American contingent, however small. The first troops, under the command of Major-General Sibert, debarked in France, June 26, 1917.

Building an American Army.—To General Pershing fell the task of creating and organizing the American Expeditionary Forces, of sufficient strength to play an adequate and decisive part in a conflict where only millions counted.

'It is evident,' the General stated in his report to the Secretary of War, the late Newton D. Baker, 'that a force of about 1,000,000 is the smallest unit which in modern war will be a complete, well-balanced and independent fighting organization. However, it must be equally clear that the adoption of this size force as a basis of study should not be construed as representing the maximum force which should be sent to or which will be needed in France. It is taken as the force which may be expected to reach France in time for an offensive in 1918, and as a unit and basis of organization. Plans for the future should be based, especially in reference to the manufacture of artillery, aviation, and other material, on three times this force—*i.e.*, at least 3,000,000 men.'

Trench warfare had begun immediately after the first battle of the Marne in September, 1914. General Pershing looked far beyond the trenches in training his men: 'Trench warfare naturally gives prominence to the defensive as opposed to the offensive,' he wrote; 'to guard against this, the basis of instruction should be essentially the offensive both in spirit and in practice. The defensive is accepted only to prepare for future offensive.'

Fourth and Last Year.—Apart from the minor activities associated with trench warfare, the winter and early spring developed no operations of importance. On March 20 the Kaiser announced: 'The prize of victory must not and will not fail us.' The German super-offensive was launched the next day. By this time Russia had made her peace with Germany and Austria-Hungary and had definitely dropped out of the war. The total German forces now numbered about 5,000,000; the Allies had at least half as many again. The Germans, however, were stronger in shock troops and enjoyed the immeasurable advantage of having but one Command, still under von Hindenburg. Lacking such unity, the French and British were practically each conducting a war on their own, with frequent disagreements among them.

March, 1918, Offensive.—The objective of the initial German drive was Amiens. Its aim was to split the French and British armies, roll the latter back against the coast, crush them by sheer weight of numbers plus the shock of surprise, and then to swing again on the French and force them to the east while slowly enveloping Paris. It was essential for Germany to strike before the French and British had been reinforced by the ever-growing strength of the United States on the Western Front. Units of Americans were already defending several so-called quiet sectors. As the Americans in one of these near Toul were recovering from a mustard gas air raid, the Germans began a violent gas attack, accompanied by intense gun fire, on a front extending from Ypres down to the Oise. The first infantry attack was made on the morning of March 21 against the Cambrai salient from Lagnicourt southeast to Gauche Wood just below Gouzeaucourt. The latter point had already proved a weak spot in December. The British were forced to retire and this especially exposed the left flank of the forces operating against St. Quentin. On the second day the

Germans assaulted on a wider front from Vimy down to La Fère and captured practically all of the British first line. Holding the French by a curtain covering the rear of their entire front, the enemy continued to hammer at the previous sector, exerting special pressure around La Fère, near which the French and British armies joined. Throughout March 23 the latter were forced back in spite of stubborn opposition to the north, and in swift succession they lost their second and many of their third positions. The Germans advanced fanwise between the Cojeul and the Sensée Rivers, recovering Quéant and their old strong line above it. Below, their wedges pointed at Péronne, Chaulnes, and Noyon. The first was entered the same day following the occupation of Roisel and Vermand and a host of villages. March 24 found the British making a stand in the north but falling back from Péronne astride of the Somme.

In the meantime the Fifth Army (Gough), which had relieved the French before St. Quentin-La Fère, had suffered most from the thick mist covering the German attack. A number of breaches had been effected and the defense demoralized. Forced gradually into the open with thinned and disorganized ranks, the retreat threatened to become a rout. Ham was abandoned on March 24, and Guiscard and Chauny the next day, and Nesle on the 25th. Pressure was expanding the front and the forces covering it became inadequate, so that a gap developed on either flank of Haig's right wing.

But the very swiftness of the retirement had exhausted the impetus of the German attack. By the time it had been recovered the invaders found themselves opposed on the eight-mile gap to the north by General Carey and his hastily gathered nondescript following. The thirty-mile gap to the south was defended and finally bridged by Fayolle, recently recalled from Italy. These two men unquestionably saved the day and the Allied cause. Meanwhile to the north the Péronne and St. Leger salients enveloped the Bapaume region and the town was abandoned on March 25. The British had already been squeezed out of the Combles salient and all of the Somme villages and woods for which they had battled so hard. The invaders had been clearing the railways, and by the next day were in Roye, Chaulnes and Bray, and commanded Noyon and Lassigny, both of which they took shortly. The struggle for Albert, an important junction and base, raged till its evacuation (March 27), with the British retiring on a wide front on both sides of the Somme, especially to the south, where Amiens was in grave danger of capture.

The next day (March 28, 1918) the attack was renewed from Arras to the Somme but with diminishing success. South, the French counter-attacked and recovered ground between Noyon and Lassigny, but Montdidier to the east was enveloped by the Germans and lost (March 29). Beginning March 23 Paris was intermittently bombarded by a giant long-range gun which caused some destruction and loss of life but did not inspire the terror hoped for. It was finally located about 74 miles away and put out of action.

By March 29 the Germans had expanded their front from 75 to 125 miles, embracing about 900 square miles in advance of their lines of March 20. Its larger salients pointed at Doullens, Amiens, Clermont, and Compiègne, all railway junctions. The next ten days marked the effort of the Germans to consolidate their gains. South of the Somme they wrested from the French more ground west of the Avre. However, by the last of the month the pressure on Amiens had perceptibly relaxed. Thus ended the first phase of the Second Battle of the Somme (q. v.) and the contest for France.

Foch Generalissimo.—At this critical stage the Allies realized that their losses were due mainly to lack of unity in command. On April 24 they selected Ferdinand Foch (q. v.) as supreme Generalissimo of all the armies.

Suddenly shifting their attack to the north, the Germans made a drive towards the Channel with the object of destroying communications between the Ypres and Arras depots, of separating the British from the Portuguese, and putting the latter out of action. The last they succeeded in doing. On the British sector, where the assault was concentrated on a 12-mile front between Fleurbaix and Givenchy, they met something like real resistance, but the next day forced the Lys at several points west of Armentières and, by renewing their attacks to its east, by April 12 had driven a wedge between it and Messines Ridge. On the latter date, in an order of the day, Sir Douglas Haig had exhorted the men to renewed effort —'With our backs to the wall, and believing in the justice of our cause, each one of us must fight to the end.' Meanwhile, the Germans had managed to clear the railway to Merville. Armentières was so saturated with gas as to be untenable for either side. For a week the battle raged around Neuve Église and Messines and Wytschaete Ridges. They changed hands several times but by April 17 were in the possession of the Germans. About this time the British began their retirement from the Merckem-Passchendaele salient, for which they had fought for three months in the preceding year. It was imperative to abandon a position so easily flanked. But below here Haig's exhortation was beginning to have its effect; resistance was gradually stiffening so that the Germans ceased to make marked progress. In the defense of this sector a small force of Americans had participated.

Ludendorff (for he had gradually taken over the German High Command) was far from satisfied with the results, though they were stupefyingly large to the Allied world. In spite of his salients north and south, the British front between the two Givenchys stood firm. Before he could safely renew the assault on a broad front, it was essential to control the heights flanking them. The Canadians had refused to give up Vimy Ridge, and the Ypres angle repulsed a frontal attack, so he turned his attention to Mount Kemmel, a link in the Messines chain. The Battle of Flanders was renewed. Prefacing his action by a massed attack against the lines astride the La Bassée Canal and a diversion near St. Venant (April 18), before nightfall he started hammering at his objective. The Germans were repelled at all points. By April 23 the British had even regained ground near Robecq and Meteren. However, by April 26, after a fierce action of four days, the Allies were compelled to withdraw from Mount Kemmel; but its loss did not lead to the evacuation of Ypres. Its defenders still held other heights of the same range. The Germans' effort to seize them passed the climax when they were driven back from Mont Rouge and Scherpenberg (April 29). Thus in a broad sense terminated the second phase of the German offensive. Between then and May 15 there were no radical changes on this front.

Meanwhile on the Amiens sector, the French had some success south of the Avre (April 18). On the 24th the Germans attacked in force at Villers-Bretonneux, 9 miles southwest of Amiens. The British lost the village but recovered it next day. Hangard, just south of it was

abandoned, then reëntered by the French on April 26. Here another unit of Americans cooperated with the French. The fight fluctuated on this front for a month, the French and Americans making gains around Hangard Wood (May 2), the British between the Somme and the Ancre (May 6). On May 11 there was a spirited action all the way from Hangard to Montdidier. A struggle near Morlancourt persisted from May 14 to 19, the Germans being finally driven back by the Australians. On the Amiens sector there were 2,200 Americans fighting, a small number, but by this time there were over half a million of them in France being trained for the counter-offensive which was to come.

German Break Through.—On May 27 Ludendorff again shifted his aim and struck a terrific blow farther east on a 40-mile front extending from Coucy-le-Château to the Aisne-Marne Canal near Brimont. The French were vastly out-numbered and fell back but in good order from the Chemin-des-Dames, but so swift was their retirement that there was no time to destroy the bridges of the Aisne, which was crossed at once by the Germans. The latter drove a deep wedge at Fismes, and the British and French were forced to abandon the Craonne on its northeast and the region covering Soissons. The Vesle was crossed on May 28, and next day Soissons fell. About 400,000 Germans were thrown across the two rivers, the Allies retiring on Rheims, the Ourcq, and the Marne. On May 30 Fère-en-Tardenois was captured and the day following the Germans were on the Marne and marching down its valley towards Paris. By this time they had smashed their way south some 30 miles and France had lost in five days fully 650 more square miles of territory; but Germany was minus a vast number of her effectives. Resistance now stiffened along the sides of an acute angle reaching from Rheims to Château-Thierry and thence northwest to Noyon.

Meanwhile, two other assaults, too heavy to be regarded as merely diversions, had been directed simultaneously at the Lys salient and the southwest angle of the one in Picardy. In the conflict at the latter, Americans of the First Division captured Cantigny, northwest of Montdidier, on May 28 and held it against repeated counter-assaults. At the Lys the Anglo-French held their ground and even made moderate gains near Dickebusch.

The situation on the Marne was becoming critical for the Allies. On May 31 the Germans were within a little more than 40 miles from Paris. At this juncture the American Second Division, together with elements of the Third and Twenty-eighth, was thrown into line. On June 3 the Germans were pressing west of the town and progressing all along the line running north. The day following the French and Americans checked them at the lower tip of the salient. This work was repeated on June 5 and bettered during the next two days, when the American Second Division and the U. S. Marines carried off a substantial counter-stroke in which they took Veuilly-la-Poterie, Torcy, and Bouresches and held them against enemy attacks.

On June 9, once more taking advantage of the light of the moon, the Germans launched their fourth offensive, this time on a front of 22 miles from Montdidier to Noyon. Their advance continued for three days, in which they captured Ressons-sur-Matz and Ribecourt on their right, where they established a wedge of about 6 miles; but the gains of their center and left were negligible and costly, while on the extremity of the latter they were not only checked but almost completely driven from Belleau Wood (June 11) by American regulars and marines. On the same day the French delivered counter-strokes which recovered some of their losses in this sector. By June 14 two more heavy blows had won back still more. On June 16 the Germans made a final effort to force the Matz near its confluence with the Oise but were repulsed with great loss. In this Oise phase of the second battle of the Marne they had used up nearly half a million effectives and their nippers had not closed on the coveted Compiègne. Their reserves were being steadily depleted, while the Allies grew stronger every day. The Italians had been able to send an army as early as April and the Americans now numbered about 800,000 and were fast being prepared for the fray. Their First Division had supported the French left before Montdidier.

On June 18 Ludendorff swung to the east again and attempted to envelop Rheims. The assaults of two days were shattered by the French artillery. Another attack was launched against the line near Bligny, southwest of Rheims, but here the Germans were repulsed by the Italians.

There followed a series of minor counter-offensives on the part of the Allies. These engagements switched rapidly from Ypres down to Rheims; now, at the Lys salient (June 28); now, on that of Château-Thierry (July 1); now, on the Somme (July 4). On July 8 an attack was launched southwest of Soissons, the next day between Montdidier and the river Oise, then back to the Avre on the 12th. Each of these operations, whether undertaken by the British, French, or Americans, led to moderate gains and captured prisoners. The Australians recovered Hamel and the Americans Vaux and the French many of their villages.

Last German Effort.—Then came Ludendorff's final attempt to break through. As if spoiling for the chance to crush the Americans, he launched his fifth drive against the front which extended from Château-Thierry up the Marne to beyond Dormans, curving around Rheims to the verge of the Argonne. The extreme right of the French front was held by the American Forty-second Division, the Marne left by the Third and Twenty-eighth. The assault was made on July 15. It was checked by the Americans on both flanks after the partial retirement of their left on Condé-en-Brie, followed by a swift counter-attack which drove the Germans back across the Marne near Château-Thierry. The Germans, however, drove a wedge to either side of Rheims and increased the penetration of both on the next two days.

Château-Thierry.—On July 18 was launched a powerful counter-attack by the French and Americans from Château-Thierry to the Aisne. The German front was indented to a depth of from 3 to 6 miles, and more than twenty villages were recovered. This stroke won the Second Battle of the Marne. The initiative had passed to Foch. With reserves to fall back upon, he pressed on and on until German resistance collapsed. In this first big counter-blow eight American divisions took part. Americans now held 100 kilometers on the French front, the British 148.

Second Battle of the Marne.—The great counter-offensive was in full swing. The French and Italians widened the German pocket which threatened Rheims (July 19); by next day the Allies had driven its makers across the Marne. On July 21 the latter were forced to evacuate Château-Thierry and swept back 4 miles by the French and Americans. Two days after, the Americans pushed them beyond the road to Soissons and by the 25th, in spite of violent counter-attacks, the Ourcq had been cleared almost to Fère-en-Tardenois. This town was reoccupied three days later. On August 2 the French

were back in Soissons; by the next night practically the whole Aisne-Vesle line to Rheims with more than fifty villages had been won. The Americans gained a foothold in Fismes (q. v.) and forced out the last Germans on August 4. Meanwhile, in the north there had been only minor activities around Albert, Ypres, and Montdidier excepting the capture of the Avre heights by the French (July 23) and an assault by the Australians covering Amiens towards the end of July.

In his *Memoirs*, Ludendorff recorded that 'August 8th was the black day of the German army in the history of the war . . . It put the decline of our fighting power beyond all doubt.' This date marked 'the beginning of the end' of the conflict. On Aug. 5 the Germans began to withdraw from all three regions. The British followed this up on Aug. 7 by attacking along the Lawe Canal in the north and the Bray-Corbie Road at the center. In the Ypres region the blow was repeated near Bailleul. On Aug. 8 an Allied drive was under way between Albert and Montdidier. Rawlinson made swift progress, but the French under Débeney were held up for a spell on the Avre, but, once over, captured Montdidier (Aug. 10), as the British were storming Chipilly Ridge on the Somme and pressing on to Bray. Elements of the American Thirty-third Division took part in the latter action. On the same day the First American Army under Pershing became a fact.

At this juncture Humbert with the Third French Army began to attack the Picardy salient from the east and menaced Lassigny. The Germans were fighting what amounted to a rearguard action from Bucquoy to near Noyon, their front approximating that of early 1916. On Aug. 18 Mangin's Fourth Army started the Aisne-Oise offensive. In two days he recovered more than that number of miles on a 16-mile front, liberating seven towns. By the 22d he was threatening the Chemin-des-Dames from the west. Humbert on his left had enveloped the Lassigny *massif* and taken it the day before. The advance was resistless. Roye was seized by Débeney on Aug. 27; Chaulnes the day after. The Juvigny Heights, which menaced the right-rear of the Chemin-des-Dames, fell before the Americans under Mangin on Aug. 29, while Humbert was capturing Noyon and the British Bapaume; for on the Somme Byng had been recovering village after village. Albert had fallen to him Aug. 22, Miraumont on the 24th. The same day Bray was won back by Rawlinson, the next found the British and Canadians breaking through the Drocourt-Quéant line. The Germans were being driven to the cover of the Hindenburg line. On Aug. 30 the French, having taken Mont St. Simeon, were able to sweep up the Oise as the Americans and French cleared Juvigny. The capture of Mont St. Quentin next day by the Australians opened the way to Péronne, which was reoccupied on Sept. 1.

Meanwhile, the British had been speeding up their offensive on the Lys salient. After a substantial gain on Aug. 9 there had been a marked lull. Then the Germans began falling back on Armentières. They were closely followed, and by Aug. 18 a fifth of the salient had been sliced off. The next day Merville was recovered and finally (Aug. 31–Sept. 2) Neuve Eglise, Mount Kemmel, and Voormezeele were reduced, with the Americans active in the capture of both the last. The Allied machine was rolling on relentlessly against Cambrai, St. Quentin, La Fère, and Laon. Quéant fell on Sept. 3 as the Germans far to the east were preparing a hasty retreat from the Vesle to the Aisne. Pursued by the Americans and French, they were driven across the latter at Condé, just west of Vailly, and the British to the north were close to Neuve Chapelle. On Sept. 6 the Germans retreated on a 90-mile front, and the French took Ham and Chauny as the Americans were enveloping Revillon near the Craonne sector. Within two days the British were clearing their old fighting-ground, Havrincourt-Gouzeaucourt Wood, and the French were advancing astride of the Oise. On the 9th, the Americans advanced on the St. Gobain *massif* and threatened Laon from the west.

St. Mihiel.—As the Germans were being driven back in a state of growing confusion, a distinctly American offensive was prepared by General Pershing, who had persuaded Marshal Foch that his combat divisions could undertake a major operation on their own. The point chosen was the St. Mihiel salient, long a thorn in the side of the French. With the French Colonials holding the tip and center of the Verdun side of this deep wedge, the attack was delivered on the morning of Sept. 12 after four hours of artillery preparation. The Germans were driven back on all quarters. Before noon almost half the wedge had been eliminated and the next day units of the First and Twenty-sixth Divisions, operating from opposite sides, met at Vigneulles, thirteen miles from the tip. By the 15th the front ran straight from Fresnes-en-Woëvre to the edge of the German boundary. The storming of the heights of Les Eparges was an especially gallant action which did much to win the day. Ten divisions took part in this operation, which recovered for France more than 150 square miles of her territory. The Battle of St. Mihiel was won by the First Corps under General Hunter Liggett. The 'arrow at the heart of France' had been broken off. (See ST. MIHIEL).

Meanwhile, there had been no let-up in other parts of the front. As the Americans continued to threaten Metz and the Briey iron basin, the reduction of the cities of the north was in progress. The French were clearing the Chemin-des-Dames, the British pressing the Hindenburg line before Cambrai and again at Epéhy below it (Sept. 21). Rawlinson and Débeney were closing in on St. Quentin.

Meuse-Argonne.—At this critical moment another smashing blow was delivered by the American army, whose performance at St. Mihiel had convinced Foch of its ability to reach an objective. On Sept. 26 began the great Meuse-Argonne offensive (the Battle of Argonne) whose goal was the Sedan-Mézières Railway, Germany's main line of lateral communication. The advance began between Avocourt to west of the Meuse near Forges, with the famous Hill 304 and Le Mort Homme not far to the rear. There were six formidable sets of defensives to be breached before the Americans could claim a complete victory. This battle raged for forty-seven days and in it 1,200,000 Americans were engaged, with casualties which amounted to 10 per cent of that number. With the French under Gouraud on their left, the Americans swept across the Forges stream, stormed a number of heights and captured on the first day Varennes and Montfaucon, the old German headquarters, with a number of villages. Advancing down the west bank of the Meuse and astride the Aire, by next day they had broken through the second line of defenses and breached the third, the Völker line. For the following few days there was violent close-quarter fighting all along the front except near the Meuse. By Oct. 4 the Germans were defending their powerful Kriemhilde line and progress became difficult. The Seventy-seventh Division had been doing remarkable work through the rough Ar-

gonne Forest. Gouraud had been advancing steadily towards Vouziers, and was now driving the Germans north of Rheims. (See ARGONNE).

Back into Belgium.—To the far north King Albert and Plumer had resumed the Battle of Flanders. On Sept. 28 they cleared the treacherous Houthulst Forest and the next day recovered Dixmude, Passchendaele, and other villages. The Belgians took Roulers on Sept. 30, as the British recovered Messines Ridge. Sweeping forward on a broad front with the French under Degoutte co-operating, the northern armies rolled back the Germans from the coast. Armentières was reoccupied on Oct. 2. During the same period the St. Quentin-Cambrai line was attacked by Byng and Rawlinson. Between them two American divisions, the Twenty-seventh and Thirtieth, were in close touch with the Australians. Marcoing and Cantaing were regained by Sept. 29, the Americans taking Bellecourt and Nauroy. On Sept. 28 Mangin had captured Fort de Malmaison and was driving the Germans off the Chemin-des-Dames. Laon would soon be untenable. Suddenly the whole western part of the German front seemed to grow thin.

The Ebbing Tide.—The end was approaching. The Allies now pressed forward on a single front from the Meuse, where the Americans were struggling through the hills of Argonne, to the sea, where Belgium was liberating her native lowlands. The French took St. Quentin on Oct. 2; a day later Lens and her coal fields were first ruined and then abandoned by the Germans. On Oct. 9 the British occupied Cambrai; the next day Le Cateau; on Oct. 18 both Laon and La Fère were won back by France with hardly a struggle.

In the Argonne, on the other hand, a continuous battle was raging. On Oct. 7, after having been cut off for five days, the American Major Whittlesey and his 'Lost Battalion' were finally rescued after an indomitable resistance. In the meantime, the extreme right had been receiving a grilling fire from the east bank of the Meuse. It was, therefore, essential to bring up the front on this quarter; and the French General (Claudel), supported by two American divisions, attacked the Austrians on this sector with striking success. The American center to the west of the Meuse was still blocked by the Kriemhilde line. By the 14th this stumbling-block had been split and the advance became more rapid.

On the same day King Albert was sweeping on towards Bruges. As the British seized Menin beyond Ypres, the Americans were drawing close to Grand Pré (Oct. 15). This town fell to them on the following day. The Germans were retiring fast. Notes had been passing as swiftly between their government and that of the United States (Oct. 7–8; Oct. 12–14). Germany was becoming anxious for peace, but played for time and endeavored to evade the Fourteen Points set forth by President Wilson as the *sine qua non* of a possible cessation of hostilities. Meanwhile the Allies continued to advance. On Oct. 17 they entered Ostend, Lille, Douai; in two days Zeebrugge and Bruges. On Oct. 21 the British Fifth Army (Birdwood) was nearing Tournai, the First Army (Horne) was on the outskirts of Valenciennes, while Plumer's Second Army was marching towards Brussels. Far to the southeast the Americans continued to drive in their wedge. Astride the Meuse, they were rapidly clearing the woods and towns on their way to Sedan. It was now merely a question of how long it would take to force the Germans back behind the Rhine. The Allies had already won the world's greatest victory. Germany recognized this and was making frantic efforts to save her armies from destruction or surrender, and her country from invasion, and to save her face as well. Bulgaria had deserted on Sept. 29; Austria was making desperate efforts to break away. On Oct. 20 another bid was made for peace in a tone more humble this time. This plea also was addressed to the United States. President Wilson's reply made negotiations conditional on the abolition of militarism and the democratization of the Empire.

The Allies had not ceased to press on; the Germans were being driven back between the Scheldt and the Sambre. On Oct. 25 the Americans of the Twenty-seventh and Thirtieth Divisions helped Rawlinson to capture the Quesnoy-Valenciennes Railway. Immediately began the final envelopment of the latter city, which was occupied by the Canadians on Nov. 3. In the north, where the Americans of the Thirty-seventh and Ninety-first Divisions had been withdrawn from the Argonne, they were helping to clear Belgium from the coast, while in the east the drive against the Germans' rear was further imperilling their position. Having made a breach in the Freya line, the last German 'Stellung' (position) on Oct. 24, the Americans began to bombard the Germans' main railway. On Nov. 1 the French on their left freed Neuchatel and Vouziers. The next day they themselves seized Buzancy. Then, as the French pushed on towards Mézières, they swept on to Sedan. They were swinging soon towards the Moselle ready to envelop and reduce Metz, but there was no need for this now save as a preliminary to occupying the Rhine Provinces. The 'Lost Provinces,' Alsace and Lorraine, were soon to witness the triumphal entry of Marshal Pétain and the Iron Division. Germany had been thoroughly beaten and had no heart to continue the struggle.

On Oct. 27, 1918, Germany declared that she was quite willing to entertain any armistice proposal. While her plea was receiving the attention of the Allied Chancelleries, the triumphant march of their armies continued and town after town was liberated. Then flashed the news which astonished the world; on Nov. 9 the German Emperor, William II, had abdicated and the Crown Prince renounced his rights; the last of the Hohenzollerns was fleeing to Holland for protection and a revolution was seething in Germany. Delegates representing a democratic Germany were soon on the way to accept the terms of Marshal Foch. They were severe terms, conditions crushing to the pride of a people who had aimed to dictate to a continent, but they were accepted.

For the terms of the Armistice signed Nov. 11, 1918, and of the Peace Treaty, signed June 28, 1919, see the articles ARMISTICE and PEACE TREATY.

Aerial Warfare.—A large number of airplane attacks were made by all the belligerents, principally upon military positions, railway centers, and factories producing war material. At the beginning of hostilities there were constant bomb droppings by German air craft upon Paris, Boulogne, and Calais, but these became less frequent for a period as the Allies increased their aerial equipment. Several raids on English towns were made. On Dec. 25, 1914, a fleet of British seaplanes and airplanes, launched from warships, attacked Cuxhaven, at the mouth of the Elbe, in retaliation for German air raids on England.

On Feb. 15 and 16, 1915, the Allies organized two extensive airplane assaults upon the naval base at Zeebrugge, Bruges, Ostend, and other Belgian towns in German possession, and considerable damage was inflicted. British aviators also dropped bombs upon the Zeppelin works at Friedrichshaven on Lake Con-

stance; but it was not until the middle of 1918 that these were finally destroyed. The French made successful air expeditions to Düsseldorf (Sept. 23), Ludwigshafen (May 27, 1915), and Karlsruhe (June 15).

With the progress of the war, the Allied raids on the bases of the Central Powers increased in frequency and violence. In a German raid on Margate, Essex, and London (June 13, 1917), 158 civilians were killed. Paris lost more than 100 killed in the raids of Jan. 30 and March 11, 1918. England's casualties in 59 raids amounted in all to 619 civilians killed and 1,650 injured.

Many more spectacular expeditions were undertaken by individual aviators or squadrons of the Allies. For example, on April 14, 1916, three British machines flew from Salonica to Constantinople, bombed the Zeitunlik powder plant, and returned to their base. On Nov. 17, Captain de Beauchamp bombed Munich, then crossed the Alps and made a landing in Italy. Essen was attacked by the French on July 6, 1917, while on Dec. 24 Mannheim received a ton of high explosives at the hands of a British squadron. Cologne was treated to a similar visitation on May 18. In return for aerial attacks on the Italian cities, Gabriele D'Annunzio with six other SVA's made the flight to Vienna, a matter of 650 miles, and bombed it with manifestoes. The routine work of such squadrons, on the other hand, was to keep attacking enemy bases and aerodromes like Zeebrugge and Ostend (for the Allies) and Sheerness, Dover and Havre (for the Germans); and the communications of course. To instance how regular were operations of this nature, some 709 raids were carried through by the British Air Force alone, from October, 1917, to the signing of the Armistice. The American flyers established a unit of their own in March, 1918, and produced a number of brilliant air fighters.

The tactics and evolutions of individual airplanes and squadrons and flying circuses had developed to a point requiring a history of its own. The Immelmann turn, the side-slip, nose-spin, and many tricks of aerial acrobatics became the common property of all experts. It was the daring French aviator, Adolphe Pegoud, killed in 1915, who was the first to 'loop-the-loop.' The aviator who brought down five opponents, each feat requiring several witnesses, became known as an Ace (borrowed from the French practice), and the leading Aces were acclaimed as popular idols. Guynemer's record is familiar. Von Richthofen, it is said shot down some 80 Allied planes; McCudden, 54; the American ace Rickenbacker, in the brief period allowed him at the front, 26. It was McCudden who after three indecisive battles with the great pilot Immelmann finally brought him down on June 21, 1916.

The Liberty engine was America's chief contribution to aviation. Her aviators brought down 755 enemy planes and lost but 357; for from 1917 the Allies gradually gained command of the air and maintained it till the close. At the signing of the Armistice America had 1,885 De Haviland-4's shipped overseas, and 3,227 completed. The first flyers in action were members of the famous Lafayette Escadrille which had served France so well, and which was transferred to the American service in December, 1917. At the close of the war there were 45 American squadrons fighting on the front. America lost 150 of her flyers, coming off lightly because her opportunity was brief. The record of France shows that of her pilots and observers 1,914 were killed while 1,451 are among the missing.

For a detailed account of the development of aviation during the war, see ARMY AVIATION; AERONAUTICS.

Zeppelins were used chiefly for raids on defenseless cities, though a time came when, outlined by powerful searchlights and subjected to the fire of anti-aircraft guns, their voyages were made at considerable risk to the crew.

One of the first Zeppelins to be shot down was near Libau, Russia, now Liepaja, Latvia, on Jan. 25, 1915. Two, the *Z-3* and *Z-4*, were wrecked off the coast of Denmark on Feb. 17.

Probably the most spectacular attack on a Zeppelin was that made singlehanded by Lieut. R. A. J. Warneford, the Canadian aviator, on June 7, 1915, near Ghent, Belgium. He successfully bombed her and for his daring received the V. C. The most disastrous raid on England for the year 1915 was made on Norfolk, Suffolk, and the suburban districts of London (Oct. 13) when 54 civilians and 17 soldiers and sailors were killed.

The first serious raid of 1916 was one on the English midland counties on Jan. 31. It cost the lives of 70 civilians. Between that date and Nov. 21 England alone suffered about 23 'Zep' raids. In the same year two airships extended their operations to Salonica, near which the second was bagged (May 6). Another bombarded Bucharest (Aug. 30) as a foretaste of what was to come. On Sept. 2 a fleet of 13 operated around London; one of them did not return.

In 1917 eight more raiders were brought down while trying to make their getaway, and five more were destroyed on the Continent. By the end of the year 66 had been accounted for since August, 1914. On the whole, the Germans now limited themselves to airplanes for raiding purposes. This type travelled more swiftly.

It has been calculated that for the period of the war there were 51 raids on England, the chief objective of the lighter-than-air machines. The casualties due to them totalled 498 civilians and 58 soldiers and sailors, killed; and 1,357 more injured of which all but 121 were non-combatants, no small proportion of them children.

Eastern Front, 1914.—At the outset of hostilities the Austrian commander-in-chief, Conrad von Hötzendorf, anxious to divert Russian support from Serbia, lost no time in despatching two armies against the great salient that was Russian Poland. One, under General Dankl, with Przemysl for its base, its left flank protected by the Vistula, was moving on Lublin by Aug. 10. The other, under General von Auffenberg, based on Lemberg and facing eastward, remained in Galicia to assist Dankl in case the Russians should turn his right flank. Dankl encountered an inferior force, which he pushed back and eastward toward the River Bug. At this juncture (Aug. 14) a Russian army under General Russky, far larger than the Austrians expected to meet, appeared in Galicia squarely upon von Auffenberg's front. The latter's retirement, fighting all the way, brought the Russians close to Lemberg by Aug. 21. Von Auffenberg was in no danger, but now a third Russian army, under General Brussilov, came up from the southeast through Tarnopol (which was taken Aug. 28) upon the Austrian right flank, and united with Russky. The Austrian general soon found his line bent back into such a dangerous horseshoe that he could do nothing but take up a new line behind Lemberg, and leave that important city to the enemy, who entered on Sept. 3. The Russians advanced rapidly toward the Carpathians to besiege Przemysl and Jaroslav, and the latter was captured on Sept. 23. Dankl, who found his flank completely uncovered, lost no time in getting out of Russian territory.

East Prussia.—Germany had expected that Austria would hold Russia until she (Germany) had finished with France, but the

Russians, proceeding hurriedly with their mobilization, were able by Aug. 7 to send two armies, totalling 250,000, neither well trained nor equipped, into East Prussia—one from the east, and one from the south. The Germans had reserve troops in that province amounting to not more than half that number. The eastern army, under General Rennenkampf, defeated the Germans in a four-day battle at Gumbinnen (Aug. 16–20). The Germans fell back in considerable disorder to the fortress of Königsberg, losing great quantities of stores and guns. The southern army, coming by the Narew River, overwhelmed a single German corps at Frankenau (Aug. 20). The Russians pressed westward. They took Allenstein, and by Aug. 25 were very close to the Vistula.

Germany met the situation with great promptness. The Russians were in a densely wooded country which is a mass of lakes, marshes, and swamps—the Masurian Lake region. Samsonov (q. v.), the Russian commander, had no knowledge of the existence of a force of nearly 200,000, drawn largely from troops still within Germany, splendidly equipped with heavy artillery, and under the command of a great general—Von Hindenburg—until it was upon him. He took the offensive at once (Aug. 26), but Von Hindenburg, in a great battle that lasted until Sept. 2, bent his line back until retreat was imperative; and this, in an all but impassable country, became hopelessly congested, while Von Hindenburg gradually enveloped him. The retreat was broken in two (Aug. 31): the northern half managed to escape with considerable loss, but the southern half met with the extreme of disaster. Of its two corps (about 80,000), 50,000 were taken prisoners and 10,000 were slain. This was the great victory of Tannenberg (see TANNENBERG, BATTLES OF), and was a splendid revenge for the devastation wrought by the enemy in East Prussia. By the middle of September all the Russians had been swept beyond the Prussian border.

First Drive at Warsaw.—By the end of September, Germany's ally, Austria, was in serious trouble and in need of assistance. Lemberg, Jaroslav, and Czernowitz were in the hands of the Russians, and Przemysl was invested. The road to Cracow, the gateway to Vienna and Southern Germany, seemed to be open.

After Tannenberg, Von Hindenburg had pursued his foes, had beaten them again at Lyck (Sept. 7), and had penetrated northern Poland as far as the Memel (Niemen) River. But the Russians suddenly assumed the offensive and won an important battle at Augustovo (Oct. 1), driving the Germans from the siege of Ossowetz (Oct. 3). By the 8th, the armies of the Grand Duke Nicholas were back in East Prussia, and had reoccupied Lyck; but, as in their first invasion, the impassable nature of the country put an end to their advance.

Early in October, the German General Staff undertook the direction of all Austrian operations, and a drive at Warsaw was planned in order to relieve the alarming Russian pressure in Galicia and Bukowina. Four German corps under Von Hindenburg invaded Poland from Silesia, and marched upon Radom and Ivangorod, putting the right flank of the Southern Russian armies in danger. Thereupon these recrossed the San, and the siege of Przemysl was temporarily raised. Austria was saved, but the Grand Duke Nicholas quickly strengthened his central forces against Von Hindenburg, who went back into Germany. The pursuing Russians made their way into Silesia and Posen, and had a battle on the banks of the Warthe River (Nov. 10). Meanwhile, in East Prussia the Russians again became active, and by Nov. 19 had driven the Germans into the Masurian Lake region, after successful engagements at Stallupöhnen and Angerburg.

With the Germans out of the way, the Russians turned again upon Austria. They reinvested Przemysl, advanced perilously close to Cracow, and some bodies of cavalry even crossed the Carpathians into Hungary. There was nothing for Germany to do but come to the rescue again.

Second Drive at Warsaw.—The German General Staff decided that the next attempt would be upon a more extensive scale. In the last days of October, 1914, the concentration of a large army was begun at Thorn, in West Prussia. In it were many regiments from France and Belgium, and it was their withdrawal which had caused the cessation of the German offensive in the West. By Nov. 12 Von Hindenburg was ready to make his second drive at the capital of Poland, as well as at the Russians who were still active in Posen and Silesia. With three corps he tried to pierce the Russian center between Lodz and Lovicz, and either surround it or drive it away from its railway communications. The battle raged from Nov. 19 to 30, when the Germans found that they were nearly enveloped, and managed to extricate themselves only after severe losses. But the bulk of Von Hindenburg's army, still further reinforced from the West, held a strong line between the upper Vistula and the Warthe, and put an end to the Russian invasion of Silesia.

Acting simultaneously with their ally, the Austrians assumed the offensive along the entire front between Czernowitz, in Bukowina, and Cracow; but before Dec. 1 they had been beaten back into the Carpathians, and Cracow was again threatened, this time on three sides. The German forces now advanced from the Warthe-Vistula line. Their progress was accompanied by many difficulties, for bad weather had set in, and the lines of communication were inadequate to the proper supply of so large a force. Another German army marched south from Kalicz in the direction of the Nida River and the upper Vistula, northeast of Cracow; while an Austrian army, organized south of the Carpathians, prepared to strike at the left wing of the main Russian army, which was again striving for Cracow.

The Russian center, between Lovicz and Pietrokow, was unable to resist the tremendous pressure exerted by the center of Von Hindenburg's army. On Dec. 7 the Russians evacuated Lodz, which the Germans entered, and formed a new line to the eastward, only to retire at once in a fighting retreat to a position (by Dec. 18) between the Bzura and Rawka Rivers, about 25 miles west of Warsaw. The Bzura became for the East what the Yser was in the West. The Germans got across in two places (Dec. 25–26), but were driven back and reduced to the defensive after the Russians had been reinforced. In the north, the desperate but unsuccessful attempts of the Russians to regain Mlawa effectually detained the left wing of Von Hindenburg's army. On the Nida, the Russians had been making headway against the Austro-German armies; but the evacuation of Lodz, and the consequent necessary reinforcement of the Bzura-Rawka line, at the expense of their left wing, in order to save Warsaw, caused them to abandon the attempt upon Cracow and retire upon Tarnow, beyond the Dunajetz River. By doing this, they were able to extend their right on a strongly defensive front as far east as Tomaszow, and their left in the direction of the River Pruth. For a second time Von Hindenburg was checked. The situation in the East at the end of 1914, ex-

cept in Bukowina, was like that in France and Belgium.

Eastern Front, 1915, found the situation on the Russian right and center very similar to that on the Western front. There were constant attacks from the borders of East Prussia through the Bzura-Rawa line in front of Warsaw, and to the southeast; but both the Germans and Russians were able to hold their lines, and no definite results had occurred. In Bukowina, however, the Russians were driving the Austrians before them. By the end of January they were in full possession of that region, had seized the Kürlibaba Pass on Jan. 16, and were on the point of pouring over the Carpathians into Hungary. This could not be done with safety, however, until the great fortress of Przemysl was in their hands, for it was the key to the railways and roads of Galicia. Austria, having by now practically abandoned operations against Serbia, was able to strengthen her armies by three corps of her own troops, and she also received some reinforcement from Germany. Early in February she was in a position to launch a vigorous offensive both in Bukowina and in the direction of Stanislau, Galicia—the latter movement having the object of stopping the pressure of the Russians upon Przemysl. In the former undertaking she was entirely successful, and the Russians were out of Bukowina before the end of the month; but the advance toward Stanislau was a failure, and the Austrians were thrown back upon Nadworna.

Third Drive at Warsaw.—Meanwhile, on their extreme right, the Russians with five army corps had again invaded East Prussia, with the object of drawing the German armies from the Polish and Galician fronts. The invasion began Jan. 26, when the Germans were pushed back upon their own territory for a considerable distance. Early in February the Russians were close to Gumbinnen in the north, and threatening Königsberg, while to the south they had passed Lyck and were marching upon Lötzen. Hindenburg quickly gathered a strong force, and on Feb. 9 made a vigorous attack upon both flanks of the invading Russian army. His main pressure was applied near Lyck, east of the Masurian Lakes. The Russians were unable to withstand this attack, and were driven in disorderly retreat across the frontier. One German column marched directly in pursuit upon Ossowetz, where it was effectively halted by Russian artillery on Feb. 23.

Von Hindenburg turned his main body south in the hope of reaching Warsaw. He got into Przasnysz (Feb. 22), but was able to stay there for only a short time. On the last three days of February a tremendous battle raged around Przasnysz, and ended in a victory for the Russians. They took many prisoners and an enormous amount of war material. This brought a sudden end to the third German attempt upon Warsaw.

Russian Successes.—The Russians were now approaching the high mark of their success. The campaign in Galicia was progressing favorably, and the Germans, in expectation of an Anglo-French offensive, had strengthened their Western front, and could spare but slight aid to their ally. On Feb. 28 the Russian army fought its way with the bayonet through the dense forests of the Tchetchava Valley, in Eastern Galicia. By March 2 it had forced the passage of the Lomnitza River. Stanislau was entered on the 5th, and a vigorous and successful assault made upon the large Austrian force in the vicinity of Nadworna. On March 12 the Russians were near the Dukla Pass, on the west, and farther east, at Nezurska, the Don Cossacks almost annihilated three regiments of Prussian cavalry.

Ten days later (March 22), after an almost continuous siege of six months, Przemysl fell. One hundred and twenty thousand prisoners were taken, the way to the Carpathian passes was opened, and the Russians were in complete possession of the railway line between Lemberg and Cracow. Reinforced by the troops which had been employed in besieging Przemysl, the Russians continued their advance toward Hungary. Rostock Pass was captured on April 3, the Varesze Pass three days later; but Uszok Pass, most important of all, could not be forced. By the middle of April the invaders were within 20 miles of the Hungarian border.

Russian Reverses.—It had now become plain that for the present, conditions in the West were not going to be as active as the German General Staff had anticipated, and consequently the German authorities felt justified in increasing the force operating against Russia. A large army under Von Mackensen, for which troops were taken both from France and from Von Hindenburg in the north, was concentrated in front of the Russian left wing, now strongly entrenched on the line of the Dunajetz and Biala Rivers.

Von Mackensen began a great drive early in May. His attack was made with a use of siege artillery hitherto unrecorded in the history of war. Batteries were massed, first in tiers of field guns, then howitzers parked behind, and finally the heaviest mobile artillery—from all of which came an uninterrupted stream of shell fire. Against this, the Russian line was powerless. At the same time, the Archduke Joseph, Austrian general-in-chief, and General Boehm-Ermolli advanced from Hungary. The Russians were badly handicapped by lack of ammunition. Both wings of their armies were bent back, and the center had to retreat, suffering great losses in prisoners. Von Mackensen struck quickly toward the San, and took Jaroslav (May 15). The Grand Duke Nicholas concentrated heavy reinforcements on the San, in the hope of keeping Przemysl, but he had to evacuate that fortress on June 3.

The third Russian line of defense, between Rawa Ruska and the Dniester, was broken by General von Linsingen, and Lemberg, which the Russians had occupied since November, fell into his hands on June 23. By the end of the month the Russians were out of Galicia (except for a small strip of territory in the northeast) and back in Poland, the Austrian right wing on the south having previously cleared them from the Carpathian front.

Fourth Drive at Warsaw.—Now was the time to strike at Warsaw, and, what was more important, to destroy the Russian armies. The situation in France and Belgium had not changed: there was still no indication of the Allies' projected offensive. Von Mackensen had moved from the San, and between Lublin and Kholm was threatening the railway connection of Warsaw with Kiev and Southern Russia. He was in a position to join Von Hindenburg's right wing. Von Linsingen and the Archduke Joseph, on Von Mackensen's right, were holding the Russians on the upper Vistula and the Zlota, as far east as the Pruth.

In the north, General von Bülow, earlier in the spring, had landed on the Gulf of Riga with a raiding army, and with but little opposition captured Libau (May 8), Windau, and Mitawa, and sent his left wing toward Riga. With the remainder of his forces he fought his way south through the provinces of Kovno and Courland, and established communications with Von Hindenburg on the Bzura-Rawa line. Thus, with both their flanks carefully guarded, the Germans in the first days of July drove at the Polish capital and the Russian

armies in what was at that time the most stupendous military movement of history.

One force advanced from the Pilitza River, and by July 19 had captured Grojetz, 20 miles south of Warsaw. From the line of the Bzura another force was on the same date at Blonie, 10 miles to the west. North of the city, the invaders were attacking the outer defenses of the Narew River, behind which ran the main line to Petrograd. By July 20 their advance was before the fortress of Novo-Georgievsk, Warsaw's great protection on the north. On the south and west the retreating Russians were at the banks of the Vistula (July 22).

Warsaw was now imminently threatened on three sides—north, south, and west. The principal effort at the moment was being made by Von Mackensen, struggling to cut the Russian communications between Lublin and Kholm. North and south the Austro-German armies were closing upon the Russians like the jaws of a vise, and in the last days of July these jaws were little more than a hundred miles apart. On the 30th, the Russian line broke in two places—on the Vistula between the mouth of the Pilitza and Kozienice, and on the Lublin-Kholm Railway near Biskupice. These occurrences compelled Grand Duke Nicholas to give up Warsaw, and draw off his armies before it was too late. Von Mackensen forced the Volika River and reached Kholm, while Austrian troops on his left entered Lublin (Aug. 1). Finally, the Blonie line gave way, and it drew back to the defenses of Warsaw.

On Aug. 4 the suburbs were in flames, and the city itself was bombarded from the air. On the 6th the Bavarian army of Prince Leopold entered from the southwest, and Ivangorod was evacuated. In fact, the whole line of the Vistula, Narew, and Memel was given up; but Novo-Georgievsk, strongest and most modern of Russian fortresses, held out until Aug. 20, when it fell before the siege artillery of General von Beseler, who nearly a year before had so speedily crumbled the defenses of Antwerp.

The main German objective being apparently the capture of the Russian armies, the pursuit was continued. The next Russian line of defense ran through Kovno, Grodno, Bielsk, and Brest-Litovsk. The Germans made this last fortress their goal, and six Austro-German armies were directed toward it, the majority of them pushing between the Narew and the Bug. On Aug. 14 Siedlce was captured. Von Mackensen worked through the swampy region east of Vladova, hoping to outflank the Russians. General von Gallwitz threatened and finally got past Bielsk. Von Hindenburg, farther north, captured Kovno (Aug. 17), and sent General von Eichhorn toward Vilna, where he was to operate with Von Bülow. This was a move to cut off the Russian armies based on Brest-Litovsk from those at Ossowetz, and the latter fortress was given up Aug. 23. To the extreme north and south Von Bülow and Von Linsingen made the Austro-German advance safe and sure by holding the flanks of the armies and keeping lines of communication open.

The fortresses of the second line were unable to withstand the great pressure, and were evacuated one by one. In the middle of September the Emperor of Russia took personal command of his armies, and sent the Grand Duke Nicholas to the Caucasus. On Sept. 16, Pinsk, 100 miles east of Brest-Litovsk, fell into Von Mackensen's hands. Meanwhile the Southern Russian armies attempted an offensive in Galicia; and the Austro-Germans made a dash for the stronghold of Sarny, whose capture would put an end to the Russian operations in the south, and place them on the defensive. By Sept. 20 the Germans had inflicted a severe defeat on their enemy southwest of Dvinsk, and were making herculean efforts to trap a Russian army of 300,000 in that region; Vilna was occupied and Riga threatened; but, as at Lodz, the Russians made good their escape, smashing their way through the cavalry sent to bar their retreat. To the south Lutsk was recovered by Brussilov on Sept. 25, only to be lost again to Von Linsingen three days later; but the Russians successfully repulsed repeated assaults on Dvinsk (Sept. 25–28), forcing back the invaders (Sept. 30) and checking the German offensive all along the front. Slight gains by Von Hindenburg (Oct. 9) were nullified on Oct. 13, which marked a Russian counter-offensive both north and south of Dvinsk and general progress in Galicia, especially in the region north of Tarnopol. The resumption of Von Bülow's drive at Riga proved ineffectual though mainly because of the presence of the Russian fleet.

With winter already at hand the Germans now deemed it advisable to return to trench warfare after a campaign of five months in the open, five months of almost unqualified triumph which had not only restored most of Galicia to Austria, but wrested for themselves from Russia all of Poland and already under Teutonic dominion, a large part of Lithuania and Courland and the northwestern corner of the Ukraine. The fall of the House of Romanov, the collapse of Russia as a military power, and the birth of Bolshevism may all be attributed to seeds sown by the reverses sustained by Russia during this period.

Russia's Last Blow.—On June 4, 1916, just as the Austrian armies of the east were celebrating what they regarded as the German naval victory at Skagerrak (Battle of Jutland), General Brussilov whose sangfroid had saved the Russian left after the disaster at Dunajetz, launched with equal assurance an offensive on a front of 275 miles. Its very audacity was staggering. The Central Powers had believed Russia incapable of taking the initiative for months to come; yet here were big guns growling from the Roumanian border to north of the Pripet River. Their hurricane fire shattered the first line. An avalanche of fresh, youthful troops swept over the Austrian positions. On two separate sectors these were [illegible] to a breadth of many miles.

The front chosen for Brussilov's drive screened Kovel, Lemberg and Stanislau, all three railway centers of the utmost importance to the Teutonic armies: the first being an indispensable link between the Austrian and German forces, the second the main feeder from Hungary. These cities were his chief objectives; their capture would spell the enemy's retirement. They were guarded by five Austrian armies: on the extreme left, resting on the Pripet Marshes, the First (Puhallo); before Rovno, the Fourth (Archduke Joseph); from Kremenetz to below Tarnopol, the Second (Boehm-Ermolli) and an Austro-German army under the Bavarian Von Bothmer (these constituting the center); and on the extreme right, the Seventh (Pflanzer-Baltin). Opposed to them were the Russian Eighth (Kaledin), the Eleventh (Sakharov), the Seventh (Shcherbachev), and the Ninth (Lechitski). The Austrians numbered at the outset about 600,000; the Russians somewhat more. The front it must be recalled, was hardly less extensive than that from Switzerland to the North Sea.

As far back as April the Russians had shown a certain activity farther north from Pinsk to Riga. Local engagements were frequent and just before the big drive Evarts and Kuroptkin

had attacked on a front reaching from Baronovichi to the Dwina, but Leopold of Bavaria had stood his ground. These operations had been in the nature of a blind. At all events, the blow delivered by Brussilov does not seem to have been expected. On the Austrian left, where the proximity of Von Linsingen may have exerted a steadying influence, the onslaught was checked near Kolki; but from there down to the Galician border, almost a hundred miles, there was no stopping an advance backed less by artillery than by cold steel. The Russians swept onward from Rovno to Olyka, some twenty miles in two days, and on June 8 recovered their fortress of Lutsk, capturing that of Dubno on June 11, thus controlling once more what, with Rovno, formed the 'Volhynian triangle.'

Crossing the Styr to the north and south of Lutsk, Kaledin's cavalry now pressed on towards Vladimir-Volynski and Kovel, his principal goal. A week's fighting had driven the Archduke Joseph back forty miles; his army was in full retreat. Shcherbachev, in the meantime, had crossed the Sereth, captured Buczacz on the Strypa (June 10), and pressed on to Przemloka, where, however, he met a stone wall in Von Bothmer. Boehm-Ermolli, to the north, also managed to check Sakharov's rush towards Brody on the railway to Lemberg.

To the south, on the other hand, Lechitski's progress was a succession of triumphs. Advancing up the right bank of the Dniester, he quickly captured Zaleszczyki and Horodenka and proceeded to envelop Czernowitz, the capital of Bukowina. What was left of Pflanzer-Baltin's army was forced to flee towards Stanislau. The Russian gains in this region were even larger than those to the north.

Czernowitz fell on June 18 and soon Bukowina was practically cleared. Von Bothmer was offering a stiff defense but was now being menaced on both flanks; Boehm-Ermolli was being pushed back on Brody. Farther north the fate of Kovel hung in the balance; but Von Linsingen was equal to the occasion. Rapidly transferring German forces from Poland, he threw them into the breach. By June 20 the Russians were being held on either side of the Styr. They were even called upon to repulse a German counter-offensive which aimed to recover the lost area. This they did in the main, slight losses being offset by the complete occupation of Bukowina (June 25). On June 30 Kolomea on the Pruth was captured and Lechitski advanced towards the Carpathians as well as up the Dniester.

The second stage of the struggle concerns Brussilov's effort to straighten out his line by eliminating the salient which covered Lemberg and the strip from below Kolki to the Stokhod River. Possession of the latter would permit a turning movement on Kovel from the north. To encompass this object a new army under Loesche was brought from the north. Upon its attack on July 1, most of the Austrian positions west of Kolki and the Styr were taken; and by July 12 the two armies were battling on the Stokhod, while the day before to the south distinct progress was made towards Vladimir-Volynski. The Russians appeared to be closing in on Kovel, but the advance in this quarter had all but exhausted itself.

Farther south, Sakharov started a new offensive along the Rovno-Lemberg Railway (July 16), and by a rapid series of heavy blows, followed by another general attack on July 20, foiled the counter-offensive which the Teutons were about to launch near Michailovka. By July 26 he had compelled Boehm-Ermolli to give battle, and routed him within 10 miles of Brody, which fell the next day. This drive brought Sakharov into a position where he too could operate against Von Bothmer's left. The Russian line had now been straightened out from the Pripet to Brody.

Meanwhile, Lechitski had been making steady progress in Southern Galicia. In the shadow of the Carpathians on July 19, by the 23rd he had driven the Austrians into the Jablonitza Pass and was within 4 miles of the Hungarian border. His other columns were operating against Stanislau and Von Bothmer's right, where, since July 9, the pressure had begun to tell. At this point heavy rains played the angel to the Austrians as they were to do for the Germans in the Somme. Floods rendered impossible any serious operations around the Dniester. Almost a fortnight passed before they could be resumed.

Meanwhile the southern defense had been reorganized by the Archduke Charles and pushed forward to retrieve the Trentino failure. His counter-thrust was launched in the Carpathians on Aug. 5 and proved ineffectual, while two days later Lechitski pressed on again towards his main objective. On Aug. 8 he cut the railway between it and Tysmienitz, which he captured the next day. Stanislau, the southern goal, fell into his hands on Aug. 11; and Von Bothmer's right fell back upon Halicz but in good order. The Bavarian's left being pressed almost simultaneously by Shcherbachev, his retirement became general up both banks of the Dniester, leading to the rapid occupation by the Russians of Nadworna, Yezerno, and a whole group of towns and villages south of the Tarnopol-Lemberg Railway. With the capture of Maryampol (Aug. 13) the Russians were within 7 miles of Halicz; and on Aug. 15 Jablonitza, that war-worn pass into Hungary, was finally taken.

Russia's armies now showed signs of being foot- and heart-sore. The price of her advance had been terrible, heartless. Her casualties ran high above the million mark. To attain her ends she had used flesh and blood instead of shells and powder. Though she had taken in recovered land and enemy territory an area one hundred-fold as vast as the final Anglo-Franco gains in the Somme, she had reached only one and that the least important of her objectives. She had crippled Austria but had not won a decisive victory over the Central Powers. Germany was still to be reckoned with. Russia's failure was her death knell as an autocracy and a nation. Unlike little Montenegro her soldiers had been driven to the attack; but, like Montenegro, their desire to defend was soon to be undermined and by agencies even more subtle.

Gradually, for lack of munitions, the great drive lost its impetus; imperceptibly, for lack of fresh martyrs, its momentum diminished. And this was occurring as the Austrians were being reinforced by Bulgarians and large bodies of Turks and, above all, German divisions; at a time when the machine was being placed under the supreme command of Von Hindenburg. Around the Stokhod there had been sporadic attacks late in July (1916), and these were resumed on Aug. 19–21 with moderate success; but on Sept. 21 the blows were being delivered by the Germans while a counter-thrust of the next day was repulsed. Again, the Russians pressed on south of Brody on Aug. 7 and Aug. 23–7; but no further progress was achieved. The vigorous offensive against Lemberg, from this quarter and the south, was launched (Oct. 1) only to relieve or appear to relieve pressure against Roumania. At all events it proved unavailing. Between the two Lipas certain gains were made near Brzezany on Sept. 4, but these were neutralized by losses far-

ther south on Sept. 16. On Oct. 22 the Russians in this sector were on the defensive. There was some advance towards Halicz on Sept. 1, and the town was being bombarded on the 7th, Von Bothmer once more retiring. By Sept. 16, prophets were predicting its early fall, but there followed (Sept. 17–19) a persistent counter-attack which was strong enough to shake this opinion.

In the Carpathians the Russian offensive was more sustained. Here the Russians were cheek and jowl with their ill-fated eleventh-hour allies, the Roumanians. Lechitski was accordingly compelled to forego further attack on Halicz, with Lemberg beckoning beyond for an offensive-defensive around the passes.

As contributory to the initial success of Brussilov's drive, one cannot wholly overlook the operations from the Pripet north. Any serious weakening of the front near Riga, Dvinsk, Vilna or from the Niemen down might have undermined his gigantic project. The Russians in these sectors not only held their ground but by their intermittent attacks prevented the withdrawal in force of the German divisions so badly needed in the south. In several instances they even made considerable gains. After the early-summer pseudo-drives around Baronovichi and Jacobstadt their pressure slackened. Then on July 5 a sudden attack by Evarts had broken Prince Leopold's defenses near the former. Two days later a heavy blow was delivered by Kuropatkin against the latter front. Both these operations were unquestionably lent as support to Loesche's thrust towards the Stokhod. Again, Lechitski's drive up the Dniester was the sign for an assault on the Riga positions (July 22–24). Here a distinct gain was effected. Early in August Kuropatkin was made Governor-General of Turkestan, the Riga-Vilna group of armies being placed once more under the command of General Russky. Under his leadership the Russian line was a rock. But to the south the Austrian line now managed to remain almost as firm. Russia's main chance had already been lost.

1917: Russia's Collapse and Defection.—At the opening of 1917 the Russian army of the north used the trick of assaulting without artillery preparation and achieved considerable gains west of Riga (Jan. 7). This offensive, with Mitau as its objective, was resumed next day and extended to include the whole front down to Lake Narotch in the Dvinsk district. A further success was scored near the Gulf of Riga on Jan. 9. A fortnight later a German counter-stroke recaptured a part of Russia's initial gains, but these were recovered on the last day of the month, which also marked a renewal of activity in Bukowina. On Feb. 1 a German counter-attack was delivered south of Halicz and broke through on a fifteen-mile front, but soon exhausted itself. There were other sporadic assaults and counter-assaults all the way from Babit Lake to Kürlibaba and thence south to the Black Sea, for Russia was still the mainstay of Roumania by her defense of the Sereth. The Russian command was on the alert, but through the rank and file was spreading the news that soon there was to be an upheaval through which every private would be as good a man as his general.

The previous autumn had reduced Russia to a state of foment. Brussilov's offensive had recovered a certain amount of her provinces but had won no decision and had wasted human lives. The Imperial Government was first criticized and then suspected of capitalizing the reverses. It was rumored that the court was pro-German, that a shameless peace was being plotted by the Emperor. His *entourage* had become limited to nobles of the Baltic Provinces, a clique whose sympathies leaned towards Potsdam, thus gradually estranging the Muscovite element. The Emperor's domination by Rasputin, a mystic of low birth, vile breeding, and infamous antecedents, believed to be in German pay, was common talk. Loathed by the Muscovites, Rasputin was assassinated on Dec. 30, 1916. The Duma, backed by the people and the army, was demanding reorganization of the government on Allied lines. In February, 1917, 100,000 workmen struck in Petrograd and 25,000 in Moscow. The lower classes faced a famine and on Feb. 18 there were riots in the capital due to food shortage. Troops were called out; they responded sullenly, and refused to fire on mobs raiding the bakeries. Sedition was growing by leaps and bounds, fostered by the Soldiers' and Working Men's Committees. Railroad transport became chaotic.

On March 12, 1917, the Emperor dissolved the Duma, but it refused to obey his ukase. Golitzin and the former premier, Stürmer, were seized, the latter, to be unceremoniously put out of the way. On March 15 Nicholas II (q. v.) was compelled to abdicate and waive the claims of his son in favor of his own brother Grand Duke Michael, who assumed the title of Regent (see Russia). On the next day the new ruler virtually abdicated, having declared that his authority must rest on the will of the whole people. A new cabinet had already been formed, headed by Prince Lvov. This provisional government was a coalition representing the three factions responsible for the revolution. Their leaders were Premier Lvov, of what might be termed the Business Men's and Landowners' League, Milyukov, of the Civil Reform Movement, and Kerensky (q. v.) of the Soldiers' and Working Men's Committee. This Ministry began well by returning to Finland her constitution, promising unity and self-government to Poland, and instituting a number of liberal measures, among them the abolition of the death penalty (Mar. 31) and an amnesty for all political offenders.

The new government recognized the Teutonic menace and on May 2 declared to the Entente that it would pursue the war energetically and 'hasten the hour of the final triumph of a regenerated Russia and her valiant allies.' This resolution came through Milyukov, the Foreign Minister. On May 16 he was ousted on the grounds of adhering to an Imperialistic policy expressly renounced by the Cabinet. A Socialist succeeded him, and Kerensky was made Minister of War. He too was against a separate peace, but his association with conservatives allowed the Petrograd Soviet to plead misrepresentation. The Soviet openly favored a separate peace, claiming that the war had been initiated and waged for the benefit of the royal castes and moneyed classes.

Meanwhile, as might be expected, there had been considerable unrest at the front. The troops were being showered with propaganda both from the rear by the Soviets and from across the lines by the German sponsors of Bolshevism (q. v.). Their growing demoralization is evidenced by the fact that from Feb. 20, 1917, until the end of April they remained on the defensive, beating off more or less successfully assaults around Lutsk and Kovel (Mar. 3 and 12), Baranovichi (Mar. 27), Kürlibaba (April 1), and the Stokhod (April 4), while they were being subjected continually to gas attacks, the most depressing form of warfare. On April 28 the political situation seeming to adjust itself, Alexeiev became more active along the whole front and on May 5, following Milyukov's declaration, the artillery

bombarded the German lines from Kovel down to Stanislau. But when it came to the assault, there was a sullen demur. The soldiers asserted that they were free agents; desertion became the order of the day; discipline broke down, reasserting itself only when called upon to repel attacks. Soon there was no reason to do that. The Germans claimed the Russians as brothers, and the two armies were fraternizing in No Man's Land. The situation was as hopeless as it was absurd.

The Grand Duke Nicholas (q. v.) had been appointed to the supreme command prior to the Emperor's abdication. No better man could have been chosen for this difficult position, but he was a Romanov and objectionable to the growing power of the radical elements. He was dismissed late in March and replaced by Alexeiev, the Chief of Staff. In utter disgust Brussilov now resigned the command of the Southern Army on May 15 but under pressure resumed his post, rebuked the Soviet delegates for interference, and was made Commander-in-Chief upon Alexeiev's resignation (June 4). Russky and a number of other good generals were being retired for political reasons. Nevertheless, the military situation began to improve. Kerensky, a patriot to the core, was exhorting the soldiers to some purpose. Those farthest from Petrograd were the most amenable to reason and, therefore, a resumption of the southern offensive with Lemberg as its objective was planned.

The sector chosen as offering the best chance of success was that covering Halicz. Here the Austrian and German forces formed a juncture; to split them would deal a double blow by further impairing Austrian morale. The initial object was to clear the western bank of the Zlota Lipa north to Zloczow. After a preliminary bombardment, which proved the Russian artillery as effective as ever, the Russians, led by Kerensky in person, rushed to the assault on an 18-mile front and won the Austro-German first lines (July 1, 1917). After consolidating their gains, they resumed their efforts, extending them to south of Brzezany, broke through on a wide front, and captured four villages. On July 6 they repulsed massed counter-attacks against the gains of the first day. The offensive then expanded down to the Carpathians (June 8–9). The Russians began, on the left, to envelop Kalusz, clearing the Stanislau railway as they advanced. On the right they hemmed in and on July 10 captured Halicz, their autumn objective, and drove the enemy across the Lomnitza River. On July 11 the Russians were progressing on a 100-mile front. The next day they captured Kalusz and Novicka just south and were threatening Strijj and Bolina and soon were investing Zloczow and Brzezany.

To the Allied world it looked as if all were going well and Lemberg would be captured once more; but, in spite of the example of Kerensky, his soldiers grew rebellious over what they deemed a needless sacrifice of lives. His appeals were jeered; mutiny followed mutiny. The assault was not to be resumed. On July 17 the Russians were driven out of Kalusz and Novicka. The last reverse steadied them a moment and the town was retaken. But only individual units would make a stand against the enemy; soon the army refused to act even on the defensive. By the 20th mutiny had spread to a point where the enemy was let through. Whole regiments laid down their arms. Complete demoralization ensued, and by July 20 Kerensky's forlorn hope had come to an end. Two days later the Russians were giving ground all along the Galicia-Bukowina front, some 150 miles. Only the extreme left in Roumania held its ground, shamed no doubt by its obligations to that sorely pressed nation. The Southern Army, on the other hand, was walking home, deserting its guns, vast quantities of ammunition and stores, all of the accessories of war for which the western Allies had loaned huge sums of money. Far to the north near the Pinsk Marshes one loyal regiment launched an attack (July 23) which loomed large against the black curtain of defection, but such isolated examples of good faith were shrouded by the eastward jaunt of the ever-expanding retirement. The Austro-Germans advanced at their leisure; already they had occupied Stanislau. Now they entered Tarnopol (July 25). There was a moment's stand by the Russians (July 30) to the east of the river Zbrocz, for this was their national boundary; but upon the enemy's occupation of Czernowitz on Aug. 3 they fell back, allowing the Austrians to invade the Ukraine. By that day only a small strip of Galicia from Brody to Zbaraz had not been returned to the Austrians. This they proceeded to relinquish. Again for a moment they stiffened as they found the Austro-Germans not satisfied to patrol both sides of the border; but shortly the villages and towns of Volhynia and Podolia were being left to their fate. It became merely a question of how much territory the Teutons thought themselves able to absorb.

Meanwhile in Russia the same despairing retirement was in progress. On Aug. 2, 1917, Brussilov resigned in favor of Kornilov. There followed a certain amount of resistance on the Baltic, but on Aug. 22 the Russians were forced to fall back on the Riga-Dvina front. Before Riga there was some semblance of a struggle, but Lechitski had a mere handful of loyal troops with which to oppose 260,000 men. The great port fell into von Below's hands on Sept. 3, 1917. The Germans were now 312 miles from Petrograd.

At the very moment of the Galician catastrophe Kerensky had succeeded Prince Lvov as Premier (July 20). He did his best to steady the army, but his power waned as that of the Bolshevists waxed. Upon the capture of Riga, Kornilov tried to avert disaster, but was deposed by Kerensky (Sept. 10). The promise that Russia was to be made a republic in no way satisfied the radicals (Sept. 15). On Oct. 18 the Germans seized Moon Island at the entrance of the Gulf of Riga and bottled up the Russian fleet. The Bolshevists immediately claimed incompetency on the part of the present cabinet. Backed by the masses of Petrograd, on Nov. 7 they seized the government, and their leaders Lenin and Trotzky became Prime Minister and Foreign Minister. Kerensky escaped, to appear later in London.

The new government demanded an immediate democratic peace and concluded an armistice with the Central Powers at Brest-Litovsk (Dec. 15). The negotiations for peace lasted over two months and were tempestuous owing to Trotzky's demands that it be based on 'no annexations, no indemnities.' The parley was broken off on Feb. 10 and the Germans resumed operations a week later, entering Rovno and Minsk as their fleet captured Reval (Feb. 20). One of their columns was within 70 miles of Petrograd. This brought Trotzky to terms and the treaty of Brest-Litovsk (q. v.) was signed on March 3, 1918. By it Russia surrendered all claims to Poland and the Baltic provinces, and renounced her rights to Finland and the Ukraine, which she agreed to recognize as independent. To Turkey she gave up Transcaucasia and its oil wells. By this treaty she lost about a half million square miles, an area almost twice as large as that of the German Empire. She also per-

mitted herself to be robbed of 30 per cent of her manufacturing industries, 75 per cent of her coal and 73 per cent of her iron. Thus with her relinquishment of the Ukrainian wheat belt, she indirectly supported Germany in the war against her former Allies. Bolshevism not only ruined Russia; its agents sowed broadcast seeds of dissension which were to threaten the foundations of society throughout the world.

Austria and Serbia: Balkan Campaigns.—An Austrian army began to bombard Belgrade, the Serbian capital, the very day that war was declared (July 28), and the government removed to Nish. The Serbs destroyed the railway bridge over the Save, and in an offensive movement not only captured and held Semlin for a few days, but prevented the Austrians from getting upon Serbian territory. Montenegro came to the assistance of her Balkan sister, and Antivari, her only seaport, was bombarded by Austrian warships on Aug. 8. The two countries planned an invasion of Bosnia, but meanwhile the Austrians succeed in getting across the Save at Mitrovitza and Shabatz, and obtained a foothold on Serbian territory. The attack on Bosnia, which had Sarajevo for its objective, was abandoned, and the full Serbian strength thrown against the Austrians. On Aug. 17 the first important battle was fought near Shabatz and resulted in a victory for the Serbs, who had retaken the town from the Austrians the day before. Austria hastened more troops from Bosnia, and the Crown Prince Alexander of Serbia attacked the reinforced enemy on the banks of the Jadar (Aug. 18). The battle raged four days, until the Austrians were completely defeated. By Aug. 23 they were out of Serbian territory. The Montenegrins continued the invasion of Bosnia, but could make no effective progress. Now, with the help of the Montenegrins, the Serbs were continuing their attempts to reach Sarajevo. They also got back on Austrian territory, and recaptured Semlin on Sept. 10. The Austrians were foiled in an attempt to cross the Save. Ragusa was besieged in the middle of October, but before the end of the month the Serbs and Montenegrins were rapidly falling back to the Serbian frontier through Visegrad and across the Drina. The Austrians, reinforced by some Bavarian regiments, swept everything before them. At Valjevo the Serbs made a stand at their last trenches (Nov. 15), but were compelled to resume their retreat.

The Serbian positions on the Danube were thus uncovered, and Belgrade had to be evacuated. One corps of the victorious Austrians, under General Franck, entered the city on Dec. 2; but their tenure was brief. Presently the arrival of King Peter put new hope into his beaten army. In the mountains S.E. of Valjevo, it turned, and with great vigor fell upon the Austrians. Their main body retreated across the Drina, and the troops in Belgrade were forced to leave the city, which the Serbs reoccupied (Dec. 14) crossing the Save and blowing up the Semlin bridge (Dec. 29).

The Montenegrins, although they had lost a third of their little army, were able to seize Visegrad again on Dec. 12, and repulsed an Austrian attack upon their front at Grahovo (Dec. 28).

From then till September, 1915, the Austrian offensive was abandoned except for slight bombardments, and Serbia, terribly ravaged by typhus fever, was in no condition to resume the initiative.

During the early months of 1915 the situation in the Balkans was quiescent, the Austrians and the Germans being fully occupied with the Russian armies (see *Eastern Front*). Meanwhile, however, Serbia, believing the entry of Bulgaria inevitable, wished to attack that country at once, but the Allies warned her solemnly not to disturb the 'Balkan peace.' With the deepest misgivings, the Serbs withdrew their troops five kilometers from the Bulgarian frontier, and when the blow fell in due course the Allies were powerless to prevent their destruction.

Operations began as early as Sept. 19 and by Oct. 9 the Austro-Germans had not only forced the passage of the Danube, Save, and Drina, but had occupied Belgrade. On Oct. 11 the Serbs succeeded in driving the German right wing back across the Drina, only to learn that the Bulgarian invasion had actually begun.

Bulgaria Declares Herself.—Bulgaria's open espousal of the Teutonic cause was due to (1) King Ferdinand's natural leaning to the Germanic Powers; (2) her resentment over the terms of the Treaty of Bucharest, which had stripped her of a large part of her conquests in the First Balkan War (see BALKAN WARS); (3) the Allies' short-sighted and maladroit diplomacy; (4) the suspension of the Dardanelles Campaign; and (5) the territorial concessions offered by Turkey and still more important ones promised by Germany.

Mobilization for the purpose of 'armed neutrality' began with the falling of von Mackensen's first shells in Belgrade (Sept. 19). Bulgaria invaded Serbia on Oct. 11, 1915, three days before her formal declaration of war which evoked Great Britain's on Oct. 15 in spite of Ferdinand's protestation that Bulgaria had no quarrel with the Entente Powers but only with her 'treacherous' neighbor, Serbia. France's declaration of the next day was followed on Oct. 19 by those of Italy and Russia, the latter stigmatizing Bulgaria's conduct as an act of fratricidal aggression.

With their communications threatened, the situation at once became desperate. While von Mackensen's two main armies were steadily hammering their way south, one Bulgarian corps advanced on Nish, a second on the Vardar Valley, and a third to effect a junction with the German army under von Gallwitz which had crossed the Danube near the Roumanian frontier. The last move, accomplished Oct. 27, partially cleared the way between Berlin and Constantinople. Meantime, Vranja had been attacked on Oct. 17 and the Salonica-Nish line cut, the same day marking the fall of Obrenovatz to the Austrians in the northwest. When Vranja fell (Oct. 21) the defenders of old Serbia found themselves in a precarious position. Only the difficult roads of western Serbia remained open for their retreat and the Bulgarians were rapidly reducing this margin between disaster and destruction.

From Oct. 12 to the end, the Allied commander, General Sarrail, distinguished for his services at Verdun, used the limited and heterogeneous forces at his disposal in Salonica as effectively as time and opportunity permitted. Not until Oct. 14 was he given a free hand, and then freedom was handicapped by the loss of most of the railway, the bad roads and general roughness of the country, and, not least, the risk of trusting to the army of Greece, on a war footing and quite patently ill-disposed. Against these odds, General Bailloud, lately in command of the French forces at the Dardanelles, had established himself at Strumnitza by Oct. 19, but was unable to reach Veles, the very keystone of Serbia's now crumbling defense, in time to save it from the Bulgarians (Oct. 28). Uskub having fallen some few days earlier, the Serbian railways were now under enemy control. The French were not strong enough to attempt to retake Veles. The Serbs, though exhausted, made a supreme effort in what is known as 'the Manœuvre of Katchanik'

(Nov. 4–8). It proved futile, and with the failure of the French to join and support the handful still holding the Babuna Pass, the gateway to Monastir, Serbia's last hope vanished. She was now entirely shut off from her Allies. On Nov. 12 was given the order for that tragic march of the southern army across the mountains of Albania.

Montenegro's Plight.—Meantime, in the north, Mount Gora on the Montenegrin sector had yielded to the Austrians (Oct. 31) under Kevesh (Koevess) and Milanovatz to the Germans who next day captured Kragujevatz, the chief arsenal, at the same time forcing the Government to flee to Mitrovitza (Nov. 2). The Serbian retirement now became general in this quarter too. After a heroic resistance Nish had to be abandoned (Nov. 6) to the Bulgarians, thereby enabled to join forces with the main German army, whose center took Krushevatz Nov. 7 and Kraljevo the day after. Owing to capture of Novi Pazar (Nov. 21) and Prishtina (Nov. 24), the Government was again transferred on Nov. 25, this time to Scutari, whence it was to be driven as soon as Austria had throttled helpless Montenegro. From this moment what had been at first a strategic retirement, then an orderly retreat, became for the northern armies the flight of a war-worn, starving rabble whose only chance of escape lay through the rough passes of Montenegro and Albania leading to the Adriatic.

A scattering of Serbians clung to the extreme south. After the fall of Prilep (Nov. 17) and the formal surrender of Monastir to the Bulgarians (Dec. 2), this remnant fell back with the Allies. By Dec. 10, when the Franco-British forces definitely withdrew to their base at Salonica, all of Serbia, save a sliver near Strumnitza in the southeast—a total of some 40,000 miles—was in the hands of the enemy. More than 100,000 men had been lost and most of the artillery and equipment. Old King Peter, broken by sickness, was a fugitive, an exile. As Havre to Belgium, so later stood Corfu to what remained of the Serbian people, army and State.

Montenegro's little army, acting on the Serbian left, had been fighting with the rearguard ever since its reverses at Mount Gora, and by the end of November had been driven back by General Kevesh to the edge of its border. Invasion followed swiftly. Ipek, the chief town of the easterly spur gained by the Balkan War, was occupied by the Austrians on Dec. 6. From this quarter their advance was materially aided by Albanian irregulars of the Mohammedan faith, but progress was slow, owing to the roughness of the country. Nevertheless, further north they had cleared the region between the Lim and the Tara by the middle of the month. In the Sanjak the Montenegrins managed to hold the invaders in check in several engagements between Dec. 23 and Jan. 2; but the net was closing in. Herzegovina and Dalmatia formed an interlocking barrier to the west and southwest, and it was a long, risky tramp to Durazzo.

When the Austrian advance, accelerating, swept down from the west and led on Jan. 10, 1916, to the bombardment of Mount Lovchen, the 'Gibraltar of the Adriatic,' Montenegro was doomed. This height dominated the Austrian port of Cattaro. Upon its capture next day, the mountain-girded harbor beneath it became at once available as a submarine base. Cettinje, the capital, was occupied on Jan. 13. King Nicholas at once pleaded for an armistice and, accepting its rigorous terms, ordered the army to capitulate (Jan. 17). The army, however, was made of sterner stuff and balked, many units refusing to lay down their arms.

While Montenegro had not pledged herself to stand or fall with the Allies, her submission damaged her prestige and virtually ended the reign of her king, who had abandoned his country on Jan. 18, leaving his son Prince Mirko to shoulder all further responsibility, and took refuge in France—first in Lyons and later in Paris—as pensioner of the French Government. The land which he had once saved from Turkish misrule was now overrun by as harsh a master. His people were disarmed, then practically enslaved and, later, if at all rebellious, deported like the Serbs. In February 1916 Prince Mirko appears to have made a manly effort to set up a new government under Austrian sovereignty; this and other measures which treated Montenegro as conquered territory were repudiated by the refugee element of the Government, which established itself first at Lyons, but in March was transferred to Bordeaux. Its leaders finally favored consolidation with Serbia, their close kin, aiming to help construct a powerful Greater Serbia.

Roumania.—During the first months of the war King Carol I of Roumania exerted every influence to the end that she should align herself with the Central Powers. Upon the death of Charles and the ascension of Ferdinand his nephew (Oct. 11, 1914), any leanings which Roumania may have had towards Germany were counterbalanced by the pro-Ally bias of her new Queen, Marie, a strong-minded British princess. The Crown Council which declared war against Austria-Hungary on Aug. 27, 1916, however much in its favor, had been bludgeoned into so doing by Russia. Roumania was forced to choose between war against the Central Powers and invasion by Russia with the concomitant dismissal of her territorial claims in the north. A loan from Great Britain turned the decision.

The threefold invasion under General Averescu followed border clashes on Aug. 27, 1916. Within three days most of the passes had been occupied, and on Aug. 30 the Austrians evacuated Kronstadt (Brasov). Vulcan Pass, forced the next day, led to the capture of Petroseny (Sept. 1), while a column of the Northern Army slipped through the Gyimes Pass and seized Csik Szereda. Incidentally, a smaller force operating from the Iron Gates took Orsova on Sept. 2 as Hermannstadt (now Sibiu) was being attacked by columns from the Vulcan Pass and along the railway from the Red Tower Pass. By Sept. 8 the Army of the North had captured Olah Toplitza and reached the Maros Valley.

In the meantime, Bulgaria had thrown off her mask (Sept. 1, 1916), and the situation on that border became exceedingly grave. Von Mackensen, the crusher of Serbia, invaded the Dobrudja with an army of Bulgarians, Turks, and Germans. On Sept. 7 he routed a Roumanian division near Turtukai (Tutrakan) and the fortress was cut off and forced to surrender with all its garrison. By the capture of Silistria (Sept. 10, 1916) he forced the remainder of the right to fall back and the eventual retirement of the whole army to the Constanza-Bucharest Railway.

The next storm burst on Sept. 20, 1916, with an attack before Hermannstadt. Here the Roumanians were severely beaten (Sept. 28–30) and one column driven back on Vulcan Pass, where a struggle had been going on since Sept. 21. The right had been cut off and compelled to escape towards Kronstadt. Thus was the First Army disorganized. The Second, its left in the air, had to abandon Fogaras (Oct. 6) and give battle before its original objective. Here, too, the Roumanians suffered defeat. Kron-

stadt fell on Oct. 8 and the shattered Second withdrew to the Predeal Pass. The Army of the North was left no alternative other than a general retirement (Oct. 12).

As von Falkenhayn battled for the passes, von Mackensen, now heavily reinforced, struck again in the Dobrudja, where he had been temporarily checked by Averescu. This time it was the Roumanian left which received the blow (Oct. 21). Through it was made a wide breach by which von Mackensen advanced on Constantza, which he occupied two days later, breaking Roumania's main water communications with Russia. On Oct. 25 Cernavoda, the great Danubian bridgehead, was seized.

Von Falkenhayn had been encountering desperate opposition in the passes. From Oct. 12 the struggle fluctuated, but the Roumanian flail was no match for the Teuton pitchfork. North the situation was hardly more favorable to the defenders. Gyimes Pass slipped out of their hands on Oct. 16, though the Austrians were repulsed at the Oitoz Pass on Oct. 24. On the same day conditions took a turn for the worse in the west. The Predeal Pass was all but abandoned, the Roumanians falling back on Sinaia. Oct. 25 marked a retirement from the Red Tower and the all-important Vulcan Pass. Soon three German columns were pressing into the Wallachian plain and on Nov. 17 what was left of the First Roumanian Army was crushed near Tirgu Jiu (Tirgoschyl). All the forces to the west were hurled back on the Iron Gates, while the remainder withdrew behind the river Alt (Aluta). On Nov. 21 one German column captured Craiova (Krajova), the capital of Western Wallachia, and started to clear the railway along the middle Jiu (Schyl), following it to Turnu Severin on the Danube, which fell on Nov. 24. Orsova being recovered for Austria on the same day. By Nov. 27 all the Roumanian forces west of the Alt were being rounded up and compelled to surrender.

Von Falkenhayn's main body, meanwhile, had swung southeast towards Bucharest. The Roumanians, threatened by still another army from the Red Tower Pass, had no choice but to retire behind the river Argesul (Arjish), the last natural defense of their capital. Von Mackensen selected this moment (Nov. 25) to force the Danube at the mouth of the Alt and at Sistova. Alexandria on the railway north of the latter fell on Nov. 27, and Giurgevo, the Danubian railhead from Bucharest on the next day, the Roumanians destroying the line as they retreated. Simultaneously, the Germans from the Red Tower Pass seized Curtea de Arges, worked down the railway, and on Nov. 29 occupied Pitesti (Pitechti), its junction with the branch from Campulung, which was forced to yield the day following. Both German commanders were fast converging on the capital. By Dec. 4 they had established contact and their united armies rolled on, a pitiless machine now under the command of von Mackensen. On that day the Roumanians were crushed after a valiant struggle on the Argesul. The capital, Bucharest, was evacuated as it was being bombarded (Dec. 6, 1916), and the day following was occupied by the Germans, the government having moved to Jassy (Nov. 28–30). Russian contingents had arrived and were co-operating on Nov. 23 near the Buzeu River, which enters the plain through the Bodza Pass. Divisions from these took part in the final stand on the Argesul, but they came too late to turn the scales in Roumania's Battle of the Marne. By Dec. 8 she had lost over half of her territory and more than 300,000 men, of whom at least one-third had been taken prisoner. The remains of the First and Second Army had fallen back on the Jalomitza River, then behind it on the capture of Ploesti (Dec. 6).

With the fall of Urziceni and Mizil on Dec. 12, and the resultant loss of the railway to the east and the north, the retirement towards the Buzeu became general. Upon the capture of Buzeu (Dec. 15), it became necessary to retreat once more, this time on the Sereth River. By the third week of December, 1916, the Roumanian front extended from near the Oitoz Pass, through Rimnicu Sarat (Rimnik), to the Danube Marshes. The Russians were defending their right; the Bulgars attacking their left in the Babadagh sector. The northeastern corner of this Dobrudja front was lost by the capture of Tultcha on Christmas Day, which marked also a severe assault on the Macin bridgehead, abandoned after a desperate resistance (Jan. 3, 1917). The defenders of this western bend of the Danube were trapped. Meanwhile the Russians had been driven out of Rimnicu Sarat on Dec. 27, and as they retired were overtaken and defeated (Jan. 1). A three-days' struggle followed for the Braila bridgehead further east, only to end in its loss on Jan. 5. The next day the Germans captured five more towns and menaced the Sereth at two points. Within four days the Russo-Roumanian army was being enveloped on the right and forced to yield valley after valley. Galatz was bombarded on Jan. 14, and a week later a final retirement behind the Sereth was in progress. Roumania had been cornered and fought to a standstill. Only a section of Moldavia remained in her hands. Her part in the World War had virtually ended.

Dating from the fall of Kerensky on Nov. 8, 1917, Roumania found herself between two millstones. Though King Ferdinand continued to give assurance that there would be no separate peace, he counted without the Bolsheviki. Upon the suspension of hostilities all along the Russian front (Dec. 6, 1917), Roumania was compelled to associate herself with the Trotzky program. Threatened with a stoppage of food from Russia, on Dec. 10 she signed a three months' armistice. An informal peace parley began at Bucharest on Feb. 4, 1918, but the conditions were regarded as prohibitive of discussion. An ultimatum from von Mackensen (Feb. 6), demanding that negotiations be begun within four days forced Roumania's hand. Bratiano's cabinet resigned and a new one was formed by General Averescu. Finally, after many protests, a preliminary treaty was signed on March 5, 1918. This was a one-sided indeterminate agreement which stripped Roumania of much territory including her seaboard, indicated further cessions, demanded transport service with hints of still further exactions, and insisted that demobilization should commence at once.

The final Treaty of Bucharest (May 6, 1918) left Roumania shorn of all but a nominal sovereignty. By it she returned to Bulgaria that part of the Dobrudja ceded by the latter in 1913 and gave to the Central Powers (Germany) the remainder of the seaboard and to Austria-Hungary the passes of the Little Carpathians and the ridge of the whole range, in all some 3,650 square miles. To the Central Powers went also the control of the Danube and wheat, salt, and petroleum concessions prolongable to a long term of years. Her army was to be reduced to a body of about 31,200 men, while the German army of occupation, maintained by the conquered, was to remain for the enforcement of Roumania's self-spoliation. Demobilization was ordered on May 16 and on July 6, 1918, the treaty was ratified by

the Senate. Roumania was humbled to the dust.

Macedonia.—The Salonika campaign and the relation of Greece to the war are too closely interwoven for separate consideration. The Allies landed at Salonika early in October, 1915, with the ostensible purpose of enabling Greece to fulfil her obligations toward Serbia. Under command of the French General Sarrail, Allied troops crossed the Serbian border, but with the loss of Monastir to the Bulgarians (Dec. 2, 1915), they again fell back on Salonika. Besides French and British forces, the troops at Salonika included Italian and Russian contingents, as well as some 130,000 Serbs, who had been rested and reorganized on the island of Corfu.

For over two years the military situation in Macedonia was a stalemate (the Germans sarcastically referring to Salonika as their 'largest internment camp'), but during 1916 the Venizelists in Greece broke definitely with the Royalists, who, they believed, were selling their country to the Bulgars. The provisional government of Venizelos at Salonika was recognized by the Allies in October, 1916, the Greek navy was taken over by the French, and on June 12, 1917, King Constantine was compelled to abdicate in favor of his second son, Alexander. Venizelos was reinstated as premier, and on July 2 Greece declared war on Bulgaria and Germany.

Little worth mentioning was accomplished in Macedonia during 1917 by the polyglot forces of the Allies. Except that in February contact had been established between the Italian main army, whose left wing rested on Valona (Avlona), a seaport of Albania, and the nondescript contingent to the east, the situation continued a stalemate. The Allied front extended from the Adriatic to the Struma, but it could not be pushed forward towards Sofia. On June 3, 1917, General Ferrero, the Italian commander in Albania, had declared that ancient race independent under the protection of Italy; but these Shkipetars, 'Rock-Dwellers,' as they call themselves, considered they were fully able to protect their interests in their own crude but independent way. Even the Tosks of the south did not enjoy the tutelage of a Latin race.

Upon Clemenceau's rise to power, Sarrail was recalled from supreme command and relieved by Guillaumat (Dec. 23, 1917). He was later replaced by General Franchet d'Esperey (q. v.).

On July 6, 1918, the Italians began an offensive up the Volyusa, the French on their right working down the Devoli. By the 24th the Italians were in Berat and were menacing Elbassan from the heights of Meli Silones, and the French were beyond the Holta. But these operations were not supported in Macedonia, and Austrian counter-attacks forced the Italians back to the Volyusa. There was another long lull, and then the big drive was launched. The forces of the Central Powers were disposed as follows: on the west, the Nineteenth Austrian Army Corps (Pflanzer-Baltin), the Eleventh German Army (von Stuben); then the Bulgar Armies, the First (Nerezov), the Second (Lukov), and Fourth (Petrov). The so-called German Army was composed almost wholly of Bulgars. General Todorov was in supreme command. Opposed to him were the Italians to just east of Lake Ochrida, 8 French divisions, 4 British, and 17 more supplied by Serbia, Greece, and Italy—all directed by Franchet d'Esperey. The Allies numbered 725,000 men, their opponents, about 450,000. Von Stuben guarded the road from beyond Monastir to Prilep.

On Sept. 15 began the battle of Sokol-Dobropolje, when the opening attack was made on a front between Lake Doiran and the Vardar. The Bulgars were driven from their first and second positions. The attack was then expanded to Monastir. By the evening of the 17th the defenses of the Sokol had been seized; the Bulgars and their allies were pressed back up the Vardar and the Cerna (to the west), and on Sept. 18 the center was broken by cavalry and aircraft. The day following a further advance was made in the Doiran region, but the center was now checked by von Stuben at Dzena Mountain. But five days later the Bulgar army was split by a drive up the Vardar. Prilep was soon entered by French cavalry (Sept. 24), and the Veles barriers were captured by the Serbs. The town fell two days later as the Anglo-Greek divisions were invading Bulgaria in force from Doiran and the British occupying her border town, Strumnitza. The Bulgars at once asked for an armistice, but were refused. On Sept. 28 a cavalry patrol reached Uskub. Serbia had been penetrated to a depth of 50 miles in a fortnight.

The Bulgar armies were now in full retreat and the Eleventh German Army was being cut off by the French under Henrys. Trapped in a blind valley, it was forced to surrender on Sept. 30. Bulgaria had already capitulated the preceding day and signed an armistice at Salonika. On Oct. 4 King Ferdinand abdicated in favor of his son Prince Boris. Meanwhile, the French were advancing north to operate against Austria. On Oct. 17 they had reached Ipek in the Sanjak province of Montenegro. The British (Milne) were preparing to support them on the Danube when ordered to advance on Constantinople (Oct. 10). The Italians continued their operations against the Austrians until the fall of Allessio (Oct. 27). Durazzo and Elbasan were already in their hands. Ere long the Serbs had recovered the whole of their territory, the keystone of a Greater Serbia.

Italian Front.—Italy and Austria had an agreement, as one of the articles of the Triple Alliance, that neither would take steps towards acquisition of territory in the Balkan peninsula without compensation to the other. Austria remained deaf to Italy's demands for territory until early in March, 1915, when under pressure from Germany she consented to discuss terms. Her offer was the southern part of Tyrol, known as the Trentino, the Italian-speaking districts on the west bank of the Isonzo, including the town of Gradisca, and the renunciation of all her interests in Albania in favor of Italy, and she further agreed to make Trieste a free imperial city. But Italy wanted the Trentino and some adjoining districts, the Isonzo valley with Gorizia and Gradisca, some islands off the Dalmatian coast, the recognition of Italian supremacy in Albania, and the foundation of an independent state on the Istrian peninsula with Trieste as its capital.

The German Emperor, deeply interested in keeping Italy out of the war as an enemy, although not directly concerned in the dispute, had sent former Chancellor Prince Bülow, a distinguished diplomat, to Rome to labor in the cause of neutrality. He succeeded in holding the political faction controlled by the former Premier, Signor Giolitti, to the side of peace; but the country at large became increasingly insistent in its demands for war upon its old-time enemy. The Cabinet was threatened with dissolution, and finally the King and Parliament yielded. Meanwhile, the Allies had been definitely sounded with the result that, in addition to the maximum concessions of Austria, Italy was promised post-bellum sovereignty over Trieste, the larger part of the Dalmatian Coast and the Dodecanese in return for active co-operation against Austria. The terms of this agreement were incorpo-

rated in the Treaty of London signed May 9, 1915. War was declared against Austria on May 23. The new member of the Entente (henceforth frequently referred to as the 'Quadruple Entente') had not been idle in the matter of war preparation since the preceding August, and she had at least 1,500,000 men, who were trained and equipped.

Hostilities began on May 24 by an Austrian airplane raid upon the arsenal at Venice, followed by attacks by sea and air on Ancona and Bari, which had insignificant results. The Isonzo River, in its upper reaches, flows through a mountainous country, which ends on the western bank south of Gorizia, and on the eastern to the north of the town. The river then enters the plain, and on the east follows the base of an elevated tableland known as the Carso (Karst) Plateau. Gorizia (Göritz), was the chief stronghold of the region, and was further guarded by the forts of Tolmino on the north and Podgora on the west.

By May 25 the Italians were across the frontier and approaching, unmolested, the line of the Isonzo. They occupied Caporetto, on the road to Tolmino, Cormons, and Cervignano, on the railway to Gorizia. In the first days of June they were at Grado, on the coast, and also at Monfalcone, on the railway between Gorizia and Trieste. The Austrians awaited the invaders on the banks of the river, and the first clash was at Gradisca, which was captured after an attack with heavy artillery. The Austrians were next driven from the heights of Castelnuovo by the charges of the bersaglieri and grenadiers.

Italian operations on sea and in the air were confined mainly to attacks on the Austrian naval base at Pola, and the islands off the Dalmatian shore, as well as a blockade of the coast of the Adriatic, including Albania. In this they suffered the loss of two cruisers—the *Amalfi* on July 8, and the *Giuseppe Garibaldi* on July 18. The Austrian submarines destroyed considerable shipping in these same waters and on Nov. 7 sunk in the Mediterranean the Italian liner *Ancona*, with the loss of 208 lives, including several Americans.

Meanwhile, attacks were being launched with varying success from Tolmino to the Adriatic (Aug. 18–Sept. 10), culminating in the furious bombardment and drive of Oct. 22. The Italians gained some ground but were attacked a week later at the Gorizia bridgehead. One of the forts of Malborghetto, to the north, yielded to the invaders on Nov. 2, and the next day marked the renewal of a general offensive. Gorizia was shelled day and night, from the air as well as land, after Austrian airplanes were known to have bombarded Verona, Vicenza, and other Italian towns.

The campaign of 1916 was launched, with the usual concentrated artillery fire, on May 14. The Italian first lines were destroyed from Lake Garda to beyond the Brenta, and next day the Austrians advanced on a front extending from that river west to the Adige. For ten days their progress was comparatively unchecked, not so much on the wings, though there they reoccupied Monte Baldo and Monte Pasubio (May 20) and many positions in the Lagarina and Sugana valleys; but at the center, where they forced the Italians to retire from the upper Astico Valley (May 19) and, driving them down through Arsiero and Asiago, gradually cleared the plateau of the Sette Communi and, descending to the plain, came eventually to within a few miles of Schio (May 31).

On June 5 the Austrians made a vain attempt to capture the position on Coni Zugna. The initiative was lost. On the same day Brussilov launched his great offensive on the Russian front. Austrian troops had now to be rushed to that quarter in the hope of saving a desperate situation, in consequence of which the Italians pressed on, reoccupying the ground they had just lost. On June 12 they made gains in the Arsa Valley, at Monte Pasubio, and along the Posina-Astico line, with further successes in these sectors of June 23–4. A general retirement of the Austrians was under way by June 26. The next day Arsiero was reëntered. Then followed the recapture of the peaks and ridges in this and the Cadore sector to the east, Giamonde and Caviojo (June 28), Trapolla (June 29), the southern slope of Spil (June 30), Corno and Sellugio (July 5). On July 14 the Italians blew up the crest of Castelletto. Thereafter their efforts slackened, only to be renewed after a general bombardment (July 21) with attacks on the Posina line and against the Dolomite defenses (July 23). Monte Cimone was finally taken on July 25 and held against Austrian assaults, July 25–Aug. 1.

Battle of Gorizia.—The Italians by this time had at their disposal a considerable number of heavy guns and hoped to smash at last through the eastern barrier, encircle Trieste, the goal of the Irredentists, and completely turn the tables on Austria. With the latter preoccupied in holding Brussilov at bay, the project seemed feasible and the moment ripe. On Aug. 4 a preliminary feint attack was delivered in the Monfalcone sector on the Adriatic. This was repulsed with poison gas. The next day the whole Austrian line from this point north to Plava Heights was subjected to a violent bombardment. This was intensified on the morning of Aug. 6, which marked the opening of the true offensive.

The Italians now technically controlled the Gorizia bridgehead. It was left to capture the bridge. From Podgara, where already they had a foothold, they launched attacks against the heights along the west bank of the Isonzo and defeated the Hungarians opposed to them. By Aug. 8 the last of the enemy had been forced over the bridge, which they blew up. With all three objectives attained, on Aug. 9, 1916, the Duke of Aosta, commander of the victorious army, entered Gorizia with the King, and by the end of August the Austrians had been driven back in all from five to eight miles on a front of about twenty-five.

There was little further progress for the Italians until Oct. 11, when another offensive, mainly of the left, led to the capture of Novavas and a large section of the Austrian defenses between Hill 208 and the Vipacco (Wippach) to its north. Finally, on Nov. 3, Monte Pecinka was cleared, and the next day the Italians were pressing up the Vipacco Valley. On the coast they were within 13 miles of Trieste, but further attempts to approach it had to await the coming of another year.

With the passing of an unusually severe winter, the Italians looked forward to a quick consummation of their hopes to regain Trieste, but they were doomed to another year of disappointment and humiliating defeat. On May 12, 1917, they began to bombard heavily the Austrian positions from Tolmino to the sea, concentrating their fire (May 14) on the Vodice Ridge and on Monte Cucco (the Kuk), both on the east bank of the Isonzo. These heights were stormed the same day and fought for tooth and nail for several days to come. The Bersaglieri and Alpini slipped across the river between Loga and Bodrez during the night but were not strong enough to establish a bridgehead. At dawn the main struggle was resumed, the Italians working their way up the slopes of Monte Cucco, and on May 17 finally gaining the crests (Hills 535 and 611), which they held against heavy counter-attacks.

Vodice Ridge was also captured in part on May 15. A similar battle for its crests ensued, ending with the surrender of Hill 652 on May 18. Meanwhile the Italians had been pressing forward in the Carso as well, seizing four of its commanding elevations and the coast town of Duino on May 17.

The offensive was resumed on May 27. Breaking through from Jamiano to the coast, the Italians cleared the railway to Medeazza and improved upon their efforts to gain its heights, the Hermada. On them was their objective, Hill 323, which dominated the country for 5 miles. On the same day north of Plava they swept the elevations at the head of the Palliova Valley, thus consolidating positions in the Monte Cucco sector.

Meanwhile, in anticipation of an offensive-defensive in other regions, Austria had started to attack near the Tonale Pass in the western Tyrol border and at several points on her northern Alpine frontier (May 31). Nor was there any diminution in her effort to drive back the invaders from the Isonzo heights. The counter-stroke of June 5 was no more successful than that of the 1st, though to it was lent the weight of an assault from Gorizia to the sea.

In the meantime the renewed assaults of the Austrians on the Asiago positions continued to fluctuate for the rest of June and through July into the second week of August. Then on the night of August 18, 1917, the great Italian drive was resumed on a front from Medeazza to about 30 miles north, and the blow was driven home by a still heavier one to the north, where a new bridgehead was established near Anhovo.

This passage of the Isonzo was one of the most spectacular stratagems of the whole war. By a great feat of engineering it was made possible to divert the water of the river every night and to construct foot-bridges which were hidden during the day by allowing the river to resume its natural course. When, after many weeks, ten of these bridges were ready for use, the Isonzo remained diverted and four pontoon bridges were thrown over as the Austrians were blinded by searchlights. The Italian infantry crossed at once on a 4-mile front from Anhovo to Loga, and by morning had gained a foothold on the northern edge of the Bainsizza.

Across the Bainsizza the Italians penetrated to a depth of almost 7 miles and were threatening to split the Austrian army by a wedge into the Chiapovano Valley. Meanwhile, further south, the Carso holding attack had resulted in important gains against the Hermada heights and along the Vipacco Valley. While the offensive was in progress an Austrian War Council had been called, with the result that special pressure was brought to bear against the Italian advance on the Carso. This now came to a standstill. Meanwhile, in far-off Russia the Germans were bringing a supposed Entente ally to terms. Just as Italy's star seemed to be in the ascendant, it was being threatened by the impact of interfused comets.

Caporetto Disaster.—Each autumn the Germans had seized the opportunity to demolish one of the weaker Allies, and now it was to be the turn of Italy. Ludendorff, preparing to consummate Russia's defeat, was led by appeals from war-weary Austria to come to her assistance, and reluctantly he sent six divisions to the Italian front. The sector opposite Caporetto was selected by the German staff as the most vulnerable, and in the attack which ensued Italy received her most crushing reverse and was crippled offensively for an entire year.

Italy was caught napping. Though her Army Intelligence was aware as early as Oct. 18 that a large number of Teutonic divisions had been withdrawn from other fronts and even advertised the fact that they were to be used against Italy, no adequate steps were taken to meet so great a menace. Cadorna seems to have remained bewitched by his Trieste venture and the objectives essential to its capture. The rest of his front was secure only so long as the initiative lay with Italy. Nor was even this wholly true; on the sector immediately adjoining the Bainsizza on the north, his defense depended overmuch on the protection of the Isonzo.

The Germans and Austrians prefaced the drive on Oct. 21, 1917, by a severe bombardment of very definite points on the Plezzo-Tolmino front, firing with even greater intensity upon the left flank of the Italians on the Bainsizza. On Oct. 24 they broke through at Plezzo, and below Tolmino they crossed the Isonzo. Working up the right bank and down the left they were able to envelop Caporetto and cut off the defenders of the Monte Nero district.

The Germans now controlled the valleys of the Judrio and Natisone Rivers and were pressing down into the Venetian Plain. Their capture of Monte Matajur on Oct. 26 made it impossible for the Italians of the shattered Second Army to make a stand between there and Ronzina-Auzza (on opposite banks of the Isonzo). On Oct. 28 Monte Santo was cut off and Gorizia captured as the German center poured into Cividale, an Italian town.

Reluctant abandonment of Cormons, the first Austrian town occupied by Italy, enabled the enemy to flank the defenders of Udine, the General Headquarters, which fell on Oct. 30. The invaders were now deploying on the Venetian plain and taking prisoners by the thousands. The strong positions which had secured the Tagliamento bridgeheads now lacked the guns to hold them, and the river was crossed all along its course (Nov. 5–6) with especial effectiveness at Tolmezzo, where a wide turning movement was in progress.

The Teutons were closing in from the Alps on a line extending from the Fella to Colbricon Pass (Nov. 6). This forced the Italians to fall back to the Livenza, the invaders in close pursuit. Meanwhile, what was left of the Second and Third Armies was being reorganized behind the Piave, more tenable than the Livenza, which was reached by the enemy on Nov. 7 and crossed the next day. At this juncture Cadorna was succeeded by Gen. Armando Diaz (q. v.), assisted by Badoglio and Giardino. The British and French arrived on the scene, but were held in reserve while making secure the line of the Adige. It was well that this support could be counted on in an emergency; for, as the Austro-Germans advanced towards the Piave, a new threat developed in the northwest.

The next phase of the conflict began Nov. 11 with the capture of Belluno on the upper Piave and the Vidor bridgehead near the point of its most westerly curve. There the Italians made a desperate stand on the heights of the Valdobbiadene. At the same time the invaders were sweeping down the Sugana Valley and attacking the Sette Comuni ridges from the east.

Italy's eastern offensive of September had become a defensive facing north. The situation was grave. The art treasures of Venice were being transferred to Rome and the south. In order to do everything possible to save Venice, the floodgates of the Piave and Sile were thrown open, and the country inundated near the coast. This move enveloped a body of the enemy which had crossed the Piave at Grisolera. The same day saw the invaders being checked from the Adriatic to Asiago. On Nov. 17, however, they forced the Piave at

two points, but this time they were driven back with great loss.

In spite of the fact that the Piave as a whole still held, the Inter-Allied Military Committee, Cadorna included, entertained little hope that the present line could be maintained. The Brenta behind it offering no special advantages to the defense, the next retirement would have to be to the west bank of the Adige. This meant the abandonment of Verona, Vicenza, Padua and, worst of all, Venice. The thought of this wrung from all Italy a violent protest which found expression in 'Da qui non si passa!' —the cry of France before Verdun. Animated by genuine patriotism, which was worked up to a fine frenzy by such popular idols as her great aviator-poet D'Annunzio, Italy laid aside *bravura* for stone-wall courage.

The problem which faced Austria was the control of the heights of the Sette Communi (often referred to as the Asiago Plateau) on the west and those of the Monte Grappa range on the east. So long as any of their crests remained in Italian hands, the advance along the Brenta between could be enfiladed.

Operations then languished till the end of the month, while the Austrians were waiting for fresh effectives. These were launched successfully against Tondarecar and Badenecche and the Miletta crests (Dec. 4–6), but could not dislodge the defenders of Sisemol. The limit of the advance on this side was a wedge down the Frenzela Valley, its apex on Valstagna, where it opens on the right bank of the Brenta. The conflict was still seesawing about Monte Tomba, but on Dec. 14 the Austrians were working up Col Caprile, which overlooks the Lorenzo Valley just east of the Brenta.

Meanwhile on Dec. 4 the British and French had been brought forward to cover Vicenza in case the line should break. The Italians were in sore need of relief, so the Anglo-French contingent now took over the eastern Grappa sector and the Upper Piave. In the former the British were flung against Col del' Rosso, but were repulsed. Two days later the Austrians took Monte Asolone south of Col Caprile, but it was recovered by the Italians after a two-days' struggle (Dec. 22). Christmas was spent fighting for Col del' Rosso, which changed hands three times in as many days. Finally on New Year's Eve the French aided by British artillery made a successful assault on Tomba.

Further south the Austro-Germans had been expelled on Christmas Eve from their salient on the west bank of the Piave. Blizzards now forced them to suspend major operations in the Alps. Italy was holding the Piave. Venice was to be preserved.

Italy's Triumph.—During the winter and spring of 1917–18 the Austro-Italian battle line did not alter materially. The opposing armies indulged in what resembled a sparring match across a rope. Diaz, like Foch, was saving his reserves almost penuriously it was thought on the French front. Then on June 15 the great rope began to take on life, to writhe like a serpent, then grow taut, as the Austrians resumed the offensive and attempted to break through. On the heights to either side of the Brenta little impression was made, but along the Piave there was some success: the river was forced once more at Fagare and also at Il Montello, and the Old Piave from Capo Sile. But the advance was brief. Within four days the movement had begun to reverse itself; and, shortly, before the vigorous Italian counter-offensive, reaching from Il Montello to the Adriatic, the invaders found themselves being forced back across the Piave at their very points of vantage (June 25–26). By July 6 the last of them had been thrown to the east bank.

Then the sparring match was renewed for months on end, until at a hint from Marshal Foch the rope grew taut from Italian pressure. There was no resisting it. The Asiago and Grappa heights began to buckle to the Italians and the French (Oct. 24), and the Piave yielded an island to the Tenth Army (Lord Cavan). The Austrian Eleventh Army could not check the Italian Fourth in the Monte Grappa region in spite of violent counter-attacks (Oct. 26). On Oct. 27 an attack was made on the Austrians facing the upper and middle Piave. The Twelfth Army (Graziani—but a Frenchman with French troops), and Eighth Army (Cavaglia) took the first lines; and the Tenth Army also made headway in spite of the Austrian Sixth Army's (Schoenberg) most stubborn opposition. The following dawn the three armies of the attack made still greater progress, the Twelfth storming the heights of Valdobbiadene, the Eighth forcing the Piave and occupying the heights of Colfosso with Susegana, while the Tenth reached its objective, Montecano.

On Oct. 29 Schoenberg found his army breaking at the center under the weight of the above attacks. At this juncture the Austrian army of the Isonzo (Wurm) endeavored to relieve the pressure by a fierce assault on the Italian Third Army (Duke of Aosta), whose right rested on the Adriatic. The move was countered by a maneuver which led to severe losses for the Austrians only. Those in the Grappa region were also in difficulties, and began to withdraw, involving the Austrian Tenth Army (Krobatin) on their right. The Italian advance became swift. While the heights of the Asiago fell to their Sixth Army (Montouri), the forces of the Piave were clearing the country to the Livenza, which was crossed by the Tenth Army and the Third as well, both deploying on the Venetian Plain. The Eighth Army was now pushing forward to Belluno while the Twelfth on its left drove the Austrians up the valley of the Piave.

These seeming miracles all occurred in a single day (Oct. 30, 1918); but the enemy was already half broken. Boroevic, who was responsible for the Austrian armies of the Piave, was experiencing something more disastrous than a Bainsizza reverse, while Commander-in-Chief, Archduke Joseph, had no von Linsingen to depend upon as at Rovno. Austria had appealed through America for an armistice the day before. As for Italy, Vittorio and Conegliano were liberated and Udine about to be restored. The roles of the Duke of Aosta and Wurm were now exactly reversed.

Lord Cavan was now leading his British troops and Italians across the Tagliamento while the 332d American regiment was soon to share the victories of those Allies on their right. On Nov. 2 the Seventh Army (Tassone) engaged the forces of Krobatin as the First (Pecori-Giraldo) began its advance on Rovereto. Before the day was ended Tonale Pass had been forced and Krobatin found himself thrown back on the Adige, pinned between the two northern Italian armies. On Nov. 3 he surrendered. Rovereto and Trent were in Italian hands at last, the Trentino was recovered. To the east, cities and countryside were being swiftly liberated; and soon Italy was in Trieste, the dream of her Irredentists realized.

Meanwhile, as the Americans were entering the arsenal at Codroipo following a lively skirmish while forcing the Tagliamento (Nov. 4), Austria accepted the terms of Diaz, her only means of securing the armistice she so earnestly desired. The Austrian Empire ceased to exist, and with it passed away the power of the Habsburgs, who had created it

against the will of weaker nations. The last Emperor, Charles, was a refugee in Switzerland.

Turkish Campaigns.—For some years Germany had been extending her influence in Turkey. Her hopes of a Pan-Germanic empire in the Near East were in great part based upon her acquiring at least a protectorate over the dominions of the Porte; and German officers (von der Goltz and Liman von Sanders) had brought the Turkish army and equipment to a high state of efficiency. The Young Turk Party, headed by Enver Pasha, the Minister of War, had been completely won over to the German cause. When the German cruisers *Goeben* and *Breslau*, which had bombarded the Algerian ports of Bôni and Philippeville on Aug. 4, 1914, and then escaped the Anglo-French fleet in the Mediterranean, sought refuge at Constantinople (Aug. 11), there was material help in the guns of German warships. At the outbreak of the war, Turkey declared her neutrality although she began to mobilize her army and navy with the assistance of officers furnished by Germany, and the German General Liman von Sanders was made general-in-chief of the Turkish army. Toward the end of October, Turkish torpedo-boat destroyers sank a Russian gunboat in the harbor of Odessa, while the *Goeben* and *Breslau*, flying the Turkish flag, but under the command of a German admiral, bombarded Theodosia (Crimea), and sent a French passenger steamer to the bottom of the Black Sea. Russia announced the existence of a state of war with Turkey on Oct. 30, and took the offensive in Armenia.

Diplomatic relations with the Allies were at once broken, and Great Britain declared war upon Turkey on Nov. 5. With their warships, France and Great Britain blockaded the Dardanelles, and Great Britain annexed the island of Cyprus. This event took place three days after the Turks had begun an advance upon Egypt and the Suez Canal.

Great Britain declared Egypt free, and replaced the Khedive Abbas Hilmi II by his uncle Hussein Kamil, with the title of sultan and broke all ties of vassalage with Turkey. A declaration of war was made by Turkey upon Great Britain on Nov. 13. Mohammed V announced a 'holy war' on Nov. 16, which did not have the desired effect, however, of inciting the Mohammedans in British India and French Africa to insurrection. The aged General von der Goltz, former chief instructor of the Ottoman army, was sent from the governorship of Belgium to Constantinople in order to strengthen the German influence.

Invasion of Egypt.—The Turks were met at the Suez Canal by the Anglo-Egyptian army and a large body of troops from Australia and New Zealand, on their way to the Western Front. The chief result of the invasion of Egypt was to keep these men out of Belgium, where they were greatly needed. But they inflicted defeat after defeat upon the Turks, who, after a last attempt to cross the Suez Canal at Tussum (Feb. 2–3, 1915), withdrew into the desert on Feb. 8, and by the end of the month had evacuated the whole of the Sinai Peninsula.

Transcaucasia.—The Russian objective was the capture of Erzerum, while the Turks wanted to get to Kars, Erivan, and Batum. The Russians were defeated in battle near Erzerum in the middle of November, but they met with success at Kara Kilissa, about 50 miles from Mount Ararat, and continued to progress toward Trebizond, whereupon, matters taking a more favorable turn in their behalf, they were also enabled to drive the Turks (Dec. 7) from several points which they had been able to occupy near Batum and administer a number of defeats to them on their own territory around Van (Dec. 20–25).

Before the end of 1914 the Turks reassumed a vigorous offensive in the southern part of the province of Kars, occupying Ardahan in the north (Jan. 2). Here the first considerable battle of the campaign ended, Jan. 4–5, at Sari-Kamysh, about 30 miles south of the city of Kars, in a decisive Russian victory. In the meantime the Turks had been fomenting trouble among the Kurds across the Persian border, instigating them to attack the Russian cantonments in the district of Azerbaijan.

Persia Invaded.—Persia, which depended upon Russia to police her frontier, refused to be drawn into the quarrel, so Turkey, interpreting the situation according to her interests, used it as a pretext for invasion. An advance force took Kotur on Nov. 15 and reached the northern end of Lake Urumiah on Dec. 20. Upon the arrival of the 12th Army Corps the Turks advanced upon the town of Urumiah, seized it (Jan. 7), occupied Tabriz, to the east of the lake, on Jan. 13, and, using this city as a base, pushed forward on Jan. 15, contemplating a thrust across the Aras River. Their success was short-lived. In spite of Russian activities in East Prussia, she had ample resources to meet the attack. The Turks were checked, defeated, and pressed back to Tabriz, where Allied property would have been destroyed save for the firm stand of the American Consul, Gordon Paddock. By Jan. 30 Tabriz was in the hands of the Russians and the Turks were in full retreat. Nor was Russia inactive to the west. Trebizond was bombarded by destroyers on Jan. 29 and again on Feb. 8; and by March 1 Russia was able to announce that she controlled the Black Sea and was able to hold her own in Transcaucasia. This was no empty boast. A Turkish resumption of the offensive in that region was checked after a three days' battle ending March 3 and was followed by further Turkish reverses, March 13–16. On March 25 the Turks were driven out of Kotur with heavy losses. Having won back Artvin in Russian Armenia (April 7), Russia was now re-established within her own territory and remained on the defensive in the north, repulsing an invading force on May 4 with severe loss to the enemy. In Persia, on the other hand, she took the initiative, directing an expedition against Van by way of the Tartar Pass. A part of this march was made at an altitude of 10,000 feet through waist-deep snow, the Kurds making progress difficult by their guerrilla tactics. At Janik, a lake village a little north of Van, the struggle became desperate. A flank attack at bayonet point gave the Russians the victory.

On the night of May 18 the Turks evacuated Van, leaving some guns and much treasure. By May 28 the Russians were able to announce a further advance in this region, including the capture of Vastan, just south of Van. Their present objectives were the cities of Bitlis and Mush. To the north, in the Vilayet of Erzerum, the Turks now resumed the offensive, crossed the border again on June 20 and defeated the Russians near Olti some 50 miles west of Kars. As a countercheck, the Russians dispatched a new expedition against the district north of Van, their object being to encircle the lake. By the end of June they were in possession of Gob, 25 miles to the north, and were pressing on towards Bitlis to the southwest. By July 13 whatever advantages had been gained in both theatres lay with the Russians. Another fortnight, however, found their tenure on Van threatened from the rear by forces from the stronghold of Bayazid and the city was evacuated. On the first anniversary of the World War operations had reached a deadlock.

Transcaucasia in 1915–16.—By the third week of August, 1915, the Russians had resumed the offensive in Transcaucasia. Van was recaptured on Aug. 16, lost the next day, and again taken the day following. The Turks were also defeated near Olti, to the north, on Sept. 12; and Oct. 3 found the invaders pressing south once more in the Van region. Thus did the see-saw continue for the rest of the year in a series of skirmish-like engagements.

Meanwhile, the Grand Duke Nicholas, relieved of his command of the main army on the Russian front, had been made Viceroy of the Caucasus with the direction of all its forces (Sept. 8). A new campaign was organized, and the Russians began a major drive on a front of more than 200 miles, from beyond the Persian border to the Black Sea. Arkhava, on the latter, was taken by the right wing (Jan. 10, 1916), while the center, extending from Tortum to Alashkerd, pressed on towards Erzerum, defeating the Turks in a decisive three-days' battle (Jan. 23). The Turkish retirement was followed by the fall of Hassankala and Kopri-Koi (Feb. 12) and opened the way to Erzerum, the eastern gate of Asia Minor, which fell on Feb. 16.

By this time the Russians of the main right wing of the invasion had routed its adversaries east of Tortum. On Feb. 18 they took Ispir on the Chorakh River; but further advance on Trebizond, their objective, was checked by the strongly defended gorges and hills which command the crossing near Baiburt. Meanwhile the army of the left had driven the Turks before it west of Melazgerd, captured Khyniskala (Jan. 28), and pressed on towards Mush, which it occupied, together with Akhlat, on the west shore of Lake Van, on Feb. 19. Joining the forces from Erzerum, it now launched an attack against Bitlis, which was taken in a snowstorm on March 2.

In the north, the Russian right was still held up before Baiburt, whereupon the line of attack was shifted and a fresh one launched from along the coast. Protected by the fleet, troops were landed (March 4) about 75 miles east of Trebizond. These, after severe fighting, forced the crossing of the Kara Dere. The Turks were compelled to fall back to Trebizond, which was being shelled from the sea, and, now threatened by an assault from the west, where a second force was disembarking, they withdrew from the city, the Russians occupying it on April 18.

That part of the Turkish army of Erzerum which had retired on Erzingan offered a far more successful opposition. For months the fight raged around Mamakhatun. The Russians captured it on March 17, only to lose it again June 1. Upon its recapture (July 12), the backbone of Turkish resistance crumbled and Erzingan fell on July 26. The loss of this town had the effect of clearing the Baiburt region of its last defenders. Baiburt itself had yielded on July 16 after a succession of fierce engagements (April 23, May 1, and May 14).

Operations in Persia, 1915–16.—In Persia itself the situation for the Allies had long been grave and delicate to handle. The Russian Consul General at Ispahan was assassinated, and an attempt was made on the life of his British colleague. Acts inimical to the Entente occurred also in Kermanshah, Hamadan, and Shiraz, where the British Consul died of wounds he received. Upon his admission of inability to comply or to protect the subjects of the Allies, the latter took the matter into their own hands, and intervention followed. By the end of October, 1915, Russia had landed a force of 24,000 men on the southern coast of the Caspian Sea, at the head of the caravan route from Resht to Teheran. From here it advanced to Kazbin in order to await developments. Earlier than this Great Britain had found herself compelled to occupy Bushire on the coast of the Gulf. When it became apparent that the Shah was about to be won over by the representatives of the Central Powers, the Russians marched on the capital. By Nov. 14 patrols had reached Herej, only 25 miles from Teheran, and on Jan. 2, 1917, Gen. Baratov occupied the city.

But Turkey had not been napping. Fully aware of the attempt on foot to attack Bagdad from the north, she had dispatched a force of Kurds, supported by regulars and officered by Germans, across the border to Kermanshah, which it entered on Jan. 14. This move had been accomplished in the nick of time, for the next day the Russians were in Kengawar, not 50 miles distant. From now on the Russian flanks were harassed by local tribesmen; but the main Turkish opposition at the two principal passes was finally destroyed on Feb. 25 and the Russians were able to occupy Kermanshah a few days later.

During the corresponding period, skirmishes had gone on south of Teheran between the Cossacks and the Persian gendarmes officered by Swedes. The latter had been completely routed at Kerim (Dec. 21), and a general advance was now made, leading to the occupation of Kum, of Kashan (Dec. 26), and eventually Ispahan on March 19, 1916. The British, on the other hand, had undertaken the pacification of Southern Persia and by June 12 were established in Kerman, its principal town. July found Russia and Great Britain in practical control of their former spheres of influence.

Asia Minor.—Returning to the operations of the opposing forces in Asia Minor proper, the Russians appeared to have the object of cutting Turkey in two by occupying a line from Trebizond southwest to the port of Alexandretta, from the Black Sea to the Mediterranean. To do this, the capture of Diarbekr was essential, for it commanded the railway terminus at Nisibin. Steady progress was made against the former town for the first part of May, but the country is extremely mountainous, and the right wing was still being held up by the resistance of Erzingan. By the time this city had fallen, late in July, and a general offensive could be resumed, the Turks, reinforced by the besiegers of Kut, in Mesopotamia (a Turkish campaign described below), were able to present a very solid front. Even more, they dared venture a counter-attack by attempting to drive a wedge through the Russian center, and succeeded, in fact, in forcing the temporary abandonment of Bitlis and Mush (Aug. 9). In the southern sector the Russian cavalry had at last effected a junction with the British on the Tigris (May 19), but the fact bore only slightly on the issues involved. A new advance on Kut was made shortly afterwards, but Russian successes in the northern and strategically vital part of this region were about to receive something more than a check.

The Turks now launched a vigorous counter-drive against the force at Khanekin (June 12), pushed it back towards Kermanshah, and defeated it between Karind and Harunabad (July 1), forcing its retirement to Kermanshah, which had to be evacuated on July 5. Nor did the Turks rest satisfied with control of the passes. They forced the Russians from Hamadan (Aug. 11) and drove them back to within 60 miles of Kazbin. They next turned their attention to the north and cleared out the Russians along the Persian border as far as Sekiz, 125 miles above Kermanshah. The Russian menace from this quarter seemed definitely checked.

As the second year of the war drew to a close, the Russian front

in Asia Minor extended in a rough curve of about 500 miles starting from a point west of Trebizond, leaving Erzingan to its east, swinging north of Kharput and south of Bitlis and Lake Van, and gradually losing itself in the Persian foothills. Russia occupied in this section of the globe foreign territory far greater in area than the lands she had been forced to relinquish to Germany on her western frontier.

Towards the middle of spring (1917) the offensive was resumed in the Hamadan region, that city having been recovered on Mar. 3. The advance towards Mesopotamia was in full progress by Mar. 7, which marked the fall of Sekiz to the north followed by Sehneh on Mar. 11. On Mar. 14 the Russians reoccupied Kermanshah. Their right crossed the border two days later, and the Turks fell back on Mosul. By April 5 the center was in Khanekin once more, and General Baratov established contact with General Maude, who was advancing up the Tigris and Diala. Then a curious situation arose. Though the armies of the Caucasus began to draw in their horns, the virus of revolution poisoning their efforts, Baratov endeavored to cooperate actively with Maude. The retirement of his expedition began early in July, however, and ended, it is difficult to say when or where.

Developments in the Caucasus remain no more easy to solve. Fighting was going on in Van as late as Aug. 8, but the Turks were on the offensive near Kharput a week later. Engagements were reported around Erzingan on Oct. 11, and a state of war still existed early in November. It is to be assumed that though during the summer Constantinople did not attract the Russia of the Provisional Government, it was essential to remain on the defensive in Asia Minor because of the co-operation pledged to the Allies. When these pledges were scrapped by the Bolshevists the soldiers felt free to journey home. At all events it was regiments formed by Armenian refugees which were opposing the Turks in the spring of 1918.

Dardanelles Campaign.— The Anglo-French attempt to force the Dardanelles and take Constantinople had for its objects: (1) breaking the link by which Turkey kept her hold as a European Power; (2) diverting a large part of the Turkish forces from operating against Russia in the Caucasus and elsewhere; (3) striking the imagination of the Balkan States by some heroic performance close to their gates; and (4) giving an outlet to Russia, which, on the closing of the Dardanelles in November, 1914, was locked up in the Black Sea and quite cut off from the Western world, except through the northern seaport of Archangel (frozen in from November to May). Great Britain and France, which had clung tenaciously to the idea of supremacy in the Mediterranean, were now compelled to undertake what they had long tried by force and diplomacy to prevent—the letting of their former enemy but present ally, Russia, out of the Black Sea and into the Mediterranean.

The Dardanelles were blockaded with some bombardment, immediately upon the entrance of Turkey into the war, which put the Turks on their guard; but no attempt to force the strait was made until Feb. 19, 1915, when a considerable Anglo-French fleet (about 100 ships of all classes), headed by the powerful super-dreadnought *Queen Elizabeth,* began operations at the entrance, and also in the Gulf of Saros. The Sedd-el-Bahr forts, at the extremity of the Gallipoli peninsula, and those of Kum Kaleh, on the Asiatic shore, were silenced by Feb. 25, and the invading fleet entered the straits which from the Sea of Marmora to the Ægean were thickly strewn with mines. On March 18, Vice-Admiral De Robeck, the British commander of the Allied fleet, having proceeded to the Narrows, about twelve miles from the entrance, opened an attack on the forts at Kilid Bahr and Chanak. De Robeck failed in his project, however, and met with great loss from large mines floated upon the attacking ships. During the engagement the French battleship *Bouvet* sank in two minutes, with a loss of over 600 men. Two hours later, the British battleship *Irresistible* went down in less than an hour; and at the close of the day the *Ocean* met with the same fate. Two other warships were disabled.

A combined land and sea expedition was next organized. This move caused the abandonment of Turkish operations against Egypt, and put the Turkish forces in the Caucasus completely on the defensive. The Australian and New Zealand Army Corps (see ANZACS), which had resisted the invasion of Egypt, and some Ghurka regiments, supported by the 29th Division of British Regulars and the Royal Naval Division, were brought to the Dardanelles. An expeditionary force, that included Senegalese troops, was sent from France. General Sir Ian Hamilton was in command of the British until the appointment of Major-General Sir Charles C. Monro (Oct. 18), while the French were led successively by Generals d'Amade, Gouraud, and, after the latter was wounded, Bailloud. The military leaders of the opposing Turks were the German Liman von Sanders and Envar Pasha, Minister of War.

Using the port of Mudros in Lemnos as a base, the transports assembled before dawn, April 25, 1915. Three major and two minor landings were effected at Cape Helles at a great sacrifice of life. As serious losses accompanied the disembarkation of the Anzacs at Gaba Tepe, to the north on the European side, a small French force seized Kum Kaleh, on the Asiatic side, in order to silence the Turkish batteries there, for they commanded the tip of the Gallipoli peninsula. The invaders found a tremendous task confronting them, for the Turks were now fully prepared.

The Allied forces occupying the two disconnected sectors of Cape Helles and Gaba Tepe or Anzac Cove (as it came to be called) were compelled to intrench themselves as best they could against a murderous and unremitting fire from the above ridges and heights; in spite of which April 27 marked an advance of 2 miles in the southern sector, this foothold having been won only by a succession of hand-to-hand struggles. The front line in this sector now extended from the mouth of the Sighir (on the Ægean) to Eski Hissarlik (on the Straits); in the Anzac sector, from Chailak Dere to Gaba Tebe, a total front of about 12 miles. Repulsing the violent night attack of May 1, the Allies drove north on Achi Baba fighting a series of battles which culminated in the onslaught of May 8 with a gain of a quarter of a mile. On June 4 a second furious attack was made and the line pushed forward from 200 to 400 yards. Another thousand yards gained on the left, June 28, all but turned the dominating height of Achi Baba, while on June 29–30 the Turks were driven back in the Anzac sector with losses of some 8,000 killed and wounded.

Some 30,000 fresh troops were successfully disembarked at Suvla Bay during the night of Aug. 6–7; but through a series of delays the key position was not attacked until Aug. 8, by which time it was occupied in force by the enemy. The failure of a final thrust at Sari Bair made against great odds Aug. 10 ended all hope of success. No further offensive was attempted. Decimated by dysentery, the Allied forces suffered still further

from the blizzard of Nov. 26–28 which cost another tenth of the whole army whose total losses were about 115,000 in killed, wounded, and missing with the sick amounting to some 100,000 more or (in all) more than two and a half times as many combatants as the original expeditionary force.

Nor were the great losses confined to the land operations. A German submarine of the newest type performed the remarkable feat of making its way from Wilhelmshaven to the Dardanelles, a distance of 3,300 miles, in forty-two days. It sank the British battleship *Goliath* on May 13, the *Triumph* (which had taken part in the capture of Kiao-chau) on May 25, and the *Majestic* on May 27. The British also lost several submarines and a transport, the *Royal Edward,* torpedoed by a German submarine (Aug. 14) with the loss of over 900 lives.

Meanwhile, members of the Allied fleet were bombarding Smyrna and other towns in Asia Minor; and British submarines were constantly active in the Dardanelles and the Sea of Marmora, destroying the Turkish battleship *Barbarossa,* and several gunboats and transports, and penetrating the very harbor of Constantinople and the Bosporus. One of these, the *E-7,* was sunk by the Turks early in September.

Owing to Bulgaria's decision to throw in her lot with the Central Powers, the vacillation of Greece and the need of manpower in other theatres of war, it was decided in November to abandon all operations against Constantinople. The evacuation of Anzac Cove and Suvla Bay lasted from Dec. 8 through Dec. 19; that of Cape Helles ended Jan. 9, 1916.

The failure at Gallipoli no doubt influenced the step taken by Bulgaria and further diminished Great Britain's prestige in the Mohammedan world. On the other hand, it held for nearly a year almost half a million Turks from action elsewhere and by its threat it had upset the whole war plans of the Germans for 1915.

Arabia.—Far south on the Arabian Peninsula, the Protectorate of Aden, which guards the entrance to the Red Sea, had been the object of several attacks, the first of any importance on July 9, 1915. The Turks and their Arab auxiliaries under Ali Saiad Pasha were repulsed at the end of a fortnight and by July 24 the British were secure in their tenure on Sheik Othman, one of the important centers of the interior. Once again (April 23, 1916), their outposts were driven back on this town, but no serious struggle ensued. The invaders were again repulsed in spite of the boastful reports of the Turkish government. From the Turks in this quarter, moreover, Great Britain was not to be threatened much longer. For months there had been a gradual rapprochement between the Allies and the semi-independent Arabs on the Red Sea. British agents not only succeeded in securing their neutrality but by keeping them posted as to conditions in Constantinople, especially as regards its domination by the Germans, shook and finally shattered their faith in the Sultan.

On June 27, 1916, El Husein ibn Ali, the Grand Sherif of Mecca, rose against the rule of the clique of Enver Pasha, proclaimed the complete independence of Arabia and openly declared in favor of the Allies. By September he had seized all the chief cities on the coast of the Red Sea and begun the administration of the region (24,000 square miles with a population of about 3,000,000) under the title of Suleiman I, King of Hejaz, a name taken from the province in which the holy cities of Mecca and Medina are situated. He was officially congratulated by the British and French Governments, who granted him a substantial subsidy in return for aid against the Turks and gave him formal recognition on Jan. 8, 1917. Many tribes from the interior flocked to his standard and peace was patched up between the sheiks of the two biggest and most powerful rival tribes near Damascus and Aleppo, these chiefs consenting to raise a large body of horsemen to serve against their former ruler. The successful enlistment of Arab support for the Allied cause was due almost entirely to a young archæologist, an amateur soldier, known later to the world as Col. T. E. Lawrence (q. v.); under his inspiring leadership the Arabs harassed Turkish lines of communication, coöperating fruitfully with the operations proceeding in Palestine (see below).

Mesopotamia.—With the immediate object of protecting the British-controlled oil fields in Asiatic Turkey, an expeditionary force of Anglo-Indian troops, numbering about 15,000 and under the command of General Barrett, was sent from the Persian Gulf into Mesopotamia. The advance brigade ascended the Shat-el-Arab (combined Tigris and Euphrates) with but little opposition, and debarked at Fao on Nov. 7, 1914, followed by the main body, which by Nov. 16 had landed in its entirety at Saniyeh, a little further up the river. Barrett was opposed by a small Turkish force under Subr Bey, who was defeated at Sahilo (Nov. 17) and compelled to evacuate Basra a few days later, retreating to Kurna, at the junction of the rivers. Kurna was surrounded, and on Dec. 9 Subr Bey was forced to surrender. Using Kurna as a base, the British advanced up the two rivers supported by gunboats. General Townshend, operating on the Tigris, won a decisive battle on May 31 and opened the way to Amara, which, after a stubborn resistance, yielded to him on June 3.

Having captured Nasariyeh, their principal stronghold on the middle Euphrates, on July 24, 1915, General Nixon made Kut-el-Amara his objective. This town is situated about 250 miles from the Gulf, so that, considering the small force and very limited supplies and transport service at Nixon's disposal, his communications were to be dangerously extended.

Operations began in a general movement to within four miles of the Turkish lines. The next morning a feint attack was launched against the Turkish right. That night the main British force was thrown across the river, deploying against the enemy on the morning of Sept. 28, 1915. Throughout the struggle the river flotilla co-operated with the infantry, striving to break through the formidable boom. Townshend was victorious, but the Turks, were able to fight a successful rearguard action and managed to reach (Oct. 5) another series of defenses at Taki Kesrah (the ruins of ancient Ctesiphon) without further serious reverses.

By Nov. 22 Townshend's main body had pushed forward to Ctesiphon, only 18 miles from Bagdad, a tempting bait to Great Britain, eager to join hands with Russia and form a barrier between the Central Powers and Afghanistan, the gate to India. But here the little army was all but overwhelmed by the Turks, powerfully reinforced since the Allied repulse at Gallipoli. In spite of a successful counter-attack the next day, it became apparent to Townshend that his position was untenable, and shortage of water necessitated an immediate retreat. Townshend was forced to give battle with his rear guard so as to insure the escape of the bulk of his army, which was ordered to proceed down the Tigris. Its retreat was successfully covered, but Townshend and his 10,000 men suffered defeat and were compelled to intrench at Kut-el-Amara. By Dec. 8 his communications had been cut. He was isolated.

Kut-el-Amara.—As soon as

the gravity of Townshend's predicament was fully realized, a relief expedition of 30,000 men was organized in India. This body, together with the two Anglo-Indian divisions which had been fighting in France, was placed under the direction of General Sir Percy Lake, with General Aylmer as field commander. Aylmer forced a crossing of the Wadi, pursued the Turks to their Umm-el-Hannah defenses, about 20 miles from Kut, and, intrenching, succeeded in blocking the egress of the enemy's right lodged between the Tigris and Suwaicha Marsh. A violent assault was made on Umm-el-Hannah on Jan. 21, but Aylmer had used all his effectives. Menaced by floods, threatened with a repetition of Townshend's fate, he was compelled to retreat to his base at Imam Ali Gherbi.

General Lake was sent to the scene and reorganized the plan of campaign. A start was made from Gherbi in February. The attack was to be directed this time against the Dujailah Redoubt and the lines running south of the Tigris. This shift from the left bank was intended as a surprise and in this respect succeeded.

The main attack, however, was hurled back with severe losses and on March 9 Aylmer withdrew to Wadi. The rest of the month was spent fighting floods as well as Turks; but by April 4 it was possible to resume operations and General Maude engineered an assault which penetrated Umm-el-Hannah and its mile-and-a-half deep maze of trenches. On April 6, Felahieh, the defenses directly to the rear, were also taken; but Sanna-i-yat, the next position, proved impregnable. Violent attacks on it were made on April 8–9, followed by a second and profitless attempt to force the Turkish right, this time at the Sinn Aftar Redoubt. After a furious bombardment (April 20–1), Sanna-i-yat was attacked for a third time. The odds were too great. The British losses to date amounted to over 8,000 men. The offensive had to be suspended. 'I need not enlarge upon the bitter disappointment felt by all ranks,' wrote General Lake, 'at the failure of their attempt to relieve their comrades at Kut.' And it was a failure that cost Great Britain 23,000 men.

These comrades in the meantime had been gradually reduced to starvation in spite of belated efforts to send them supplies by airplane. Eight tons had been dropped into the besieged camp —a drop in the bucket. An attempt to reach them by the river ended disastrously. On April 29, 1916, Townshend was compelled to surrender unconditionally to Khalil Pasha after a resistance of 143 days. Most of the guns and ammunition had been destroyed or dumped in the Tigris, but the Turks nevertheless obtained much booty.

Great Britain learned for the second time within a year the cost of seeking to emulate Xenophon in a country where the enemy was in vastly superior numbers, equipped almost as well as she and directed by a power perhaps superior in strategy.

Bagdad and Beyond.—After Lake's failure to relieve Kut-el-Amara, followed by Townshend's surrender, the Mesopotamian forces were reorganized and placed under the direction of General Maude. In December (1916) the Turks still held the positions which had proved impregnable to Lake. Maude's preliminary operations consisted in a successful effort to gain control of the Hai River (Dec. 13–15). On Jan. 11, 1917, General Marshall had begun hammering away at the Hai salient which embraced the river close to the Tigris, and during the night of Feb. 3 the last Turks were forced to retire, allowing the British to occupy all of the left bank of the Hai the next day.

The succeeding objective was the Dahra Bend of the Tigris, which was cleared on Feb. 15.

On Feb. 24 Sanna-i-yat was captured, and all opposition in this quarter was definitely shattered. Kut was reoccupied and British honor redeemed. By this time Marshall had worked his way up and out of the Shumran peninsula, where he had been held, however, long enough for the main Turkish force to escape.

Bagdad.—Resuming the pursuit on March 5, 1917, Marshall pressed on to Zeur, the cavalry preceding him to Lajj, 25 miles from Azzizieh. The next day found the cavalry on their way through an abandoned Ctesiphon and close to the Diala (Jahla) River, a northerly branch of the Tigris. Meanwhile Marshall's infantry was following close and Cobbe's force was protecting his rear from Zeur. The succeeding four days were spent establishing the Tigris-Diala bridgehead. A passage was forced and by noon of March 10 a bridge had been completed and Marshall was advancing on Bagdad, 8 miles distant. His approach was made up the east bank of the Tigris. Meanwhile on the 8th that river had been crossed below the Diala by Cobbe. Shawa Khan was occupied next morning and the Turkish rearguard driven back by the cavalry, which was soon on the outskirts of the great city. Early on March 11 the Bagdad Railway Station was being guarded by British troops. Marshall, on the other bank, by dawn of the same day was in possession of the Tel Mohammed Ridge, the city's last defensive position on the left bank. Early that afternoon he entered Bagdad and restored order. Maude's proclamation of the same date called upon the people to follow the example of the natives of Hejaz by throwing off Turkish tyranny, with the suggestion that they 'participate in the management of their own civil affairs.'

On March 14 the Turkish rear made its final stand at Mushaidia, about 20 miles north, and was routed. A few days later Baquba on the Diala was seized, while on March 19 the British were in Feluja to the west of Bagdad and now controlled the middle Euphrates down to Nasariyeh. The rest of the month was consumed working up the Diala, to the headwaters of which the Russians were fast advancing by way of Kermanshah, which they had captured a second time on March 14.

General Maude established contact with General Baratov on April 2, 1917. Anticipating this event, a general advance had been under way since March 31, and now that the British right was secured by the Russians on the Diala, on April 12 Maude started clearing the Bagdad Railway, marching astride the river towards Samara, the next important town. A British column engaged the Thirteenth Turkish Corps, which had been retiring before the Russians, near Deli Abbas and put it to route, occupying the town on the same day (April 15).

The advance on both banks of the Tigris could now be resumed. Near Istabulat, the left wing found itself confronted by a strong system of defenses extending from the river across the Dujail Canal to the railway line. A vigorous attack, first on the north and then on the south, threatened to cut out the center and compelled the enemy to withdraw on the morning of April 22. Later on the same day the British caught up with them and inflicted a decisive defeat. Retreating with all haste, they made only a weak attempt to hold the Samara Railway Station, which fell into British hands on the next day, the town on the opposite bank yielding on April 24.

The excessive heat of the Mesopotamian summer now caused a lull broken momentarily when it was learned that the Russians contemplated withdrawing from the Diala dis-

trict. On July 15 they abandoned Khanekin and retired slowly on Kermanshah. To protect his right and rear, more especially from Kurdish incursions, Maude detached troops for the occupation of Beled Ruz and the control of the Baquba-Mendali region. Outposts were established by June 23.

The capture of Ramadie (Sept. 28) extended the British control of the Euphrates-Tigris basin and commanded the Aleppo caravan route, which near Werdi branches off towards Damascus. Undiscouraged by the loss of Russian support, Maude now swung north again and renewed his clearing operations above Samara. The Turks defending Tekrit, some 90 miles beyond, were defeated on Nov. 5, and compelled to fall back on Mosul, their main base. The Russian collapse now seriously threatened the British on the north and northeast and made further advance inadvisable for the present. Maude proved himself a cautious leader as well as an able strategist to the very end of his career. As Jaffa fell to Allenby (see below), he was carried off by cholera in Bagdad (Nov. 18, 1917). General Marshall succeeded to his command on Nov. 24.

General Sir Stanley Maude (q. v.) had achieved the main objects of a long and arduous campaign, the fruits of which were destined to end Turkish resistance and force the Sublime Porte to sue for peace.

Palestine.—Early in 1915 the Turks had desisted in their attempts to attack Egypt, but on July 22, 1916, they were discovered to be advancing in force along the coastal caravan route once more, and by the last day of the month had reached within nine miles of Romani, southeast of Port Said. Exhausted by their long march across the desert, their defeat at Romani (Aug. 4, 1916) was only a question of hours, and thus ended the much-advertised occupation of Suez, blockade of India, and conquest of Egypt.

With Aleppo as the ultimate objective, the invasion of Palestine was then undertaken, the British forces being placed under the command of General Allenby (q. v.). On Dec. 21, 1916, came the capture of El Arish, 90 miles east of the Canal. This stronghold on the northern route was connected with the other two lateral routes from Suez to Akaba, on the gulf of that name, and fairly well supplied with water. It was furthermore the head of a light railway from Beersheba. Its surrender crippled opposition in this quarter. The British military line could now continue on its plodding way from El Kantara to Rafa and the Syrian Railway, which it was destined to join. This was a campaign in which engineers played a more than ever important part. By them was the Nile piped across the Sinai Peninsula to Palestine and locomotives permitted to do the heavier transport work which had fallen at first entirely on native porters and camels. Of the latter over 50,000 had been employed, a large number of them imported from Afghanistan and India and as far east as the Australian deserts.

The capture of El Arish was followed promptly by a victory over the Turks at Maghdaba on the central route, which led to the complete clearing of the lower peninsula. Rafa captured, invasion was under way by the end of February, 1917, beginning with a 15-mile march to the Wadi Ghuzzeh, a dry watercourse 5 miles south of Gaza. Turks before this town attacked on March 26 but were repulsed and routed next day by General Dobell, the Australian Camel Corps distinguishing itself against their cavalry. In the early hours of Oct. 31, 1917, a surprise attack was launched at Beersheba, and by twilight the city was in British hands. The defeat of the Turkish left and loss of its base led to the complete investment of Gaza, which was the next to fall (Nov. 7).

On Nov. 9 Ascalon, famous in the annals of the Crusaders, was captured. The next day the British left was near Esbud, and by the 15th they had seized the junction of the Beersheba-Damascus Railway and were on a line extending through Er Ramleh and Ludd to just south of Jaffa (the ancient Joppa). This town, the port of Jerusalem, yielded on Nov. 18. The Holy City was being invested with little opposition. By Nov. 24 the British had occupied the site of ancient Mizpah, and three days later were within a few miles west of their objective. With the fall of Hebron on Dec. 7, the Turkish rear was threatened and the British triumph a question of hours.

In order to save Jerusalem from the rigors of war, a chance was given the Turkish garrison to retire by the Eastern Gate. Upon their evacuation, the ring was closed by columns advancing from Hebron and Bethlehem and by Dec. 8 the heights had been cleared of their last defenders. The town was surrendered to General Chetwode by its mayor early on Sunday morning, Dec. 9, 1917. Upon Dec. 11 General Allenby entered the Holy City on foot, accompanied by military attachés or civil agents of the Allies. At the Jaffa Gate he was 'received by guards representing England, Scotland, Ireland, Wales, Australia, New Zealand, India, France, and Italy.' Soldiers from all these lands had battled to win back the Holy Sepulcher, and it is hard to say which had fought the most zealously, the Anzacs, the Cockneys, the Gurkhas, the Poilus and other contingents indicated, or the Arabs, whose light cavalry proved of invaluable service. Now, not only the holy places of the Christians were protected, but those of the Moslems were placed under Mohammedan control. A proclamation covering this and other conditions of occupation was framed in seven tongues and posted on the Citadel. Thus in all dignity was the final Crusade achieved and its success crowned by making the goal of many pilgrims truly free for the first time in history to the religionists of conflicting creeds. (See Jerusalem).

Collapse of Turkey.—After the capture of Jerusalem General Allenby directed all his efforts towards his main objective, the Bagdad Railway. Several points on the Damascus branch were secured before the new year began; then the operations slackened until the following February. On the 19th of that month the British began their advance on a front extending from the Dead Sea to the coast, with the object of clearing the region to Damascus. Jericho was in their hands by the end of the month; but the resistance grew more stubborn, and it was May before one column could reach Es Salt, 20 miles north of the Holy City. This position was abandoned pending the resumption of the general offensive.

Meanwhile, in Mesopotamia Marshall had resumed operations as soon as he was reasonably secure on his right flank, and the rivers permitted. On March 10 he had occupied Hit on the Euphrates, the Turks falling back on Khan-Baghdadi. Advancing up the river, the British right wing proceeded to invest the latter (March 26). The left wing (Cobbe) operating on the Tigris now pressed on again, reoccupied Tekrit, and reached a point not far from Fatha, 80 miles south of Mosul, their objective. Operations were now suspended in both this region and Palestine owing to the summer heats.

In the latter region Allenby withdrew some of his forces from the Jordan Valley and attacked the Turkish Seventh and Eighth Armies under General Liman von Sanders. He struck on Sept.

19, and by next day had shattered the Seventh so that it retreated in disorder through the Hills of Samaria. The Eighth Army he crushed so that it was easily rounded up and forced to surrender. The Fourth and last Army, in the Valley of the Jordan, was driven back by the Arab forces of the King of Hejaz, directed by Col. Lawrence. By Sept. 22, 1918, the British cavalry was in Nazareth. In quick succession they entered Haifa and Acre and Tiberias, overrunning the region to the south and west of the Sea of Galilee. The Camel Corps was off for Damascus, dispersing units of the Fourth Army on the way. Bulfin's infantry, which had worked the initial havoc, was pressing steadily north. That part of the Turkish Fourth Army which had withdrawn east of the Jordan was being flanked by the Arabs, who finally cut off its retreat and allowed it to be despatched by the Anzacs. Within ten days the Turkish resistance had ended. Damascus was reached on Oct. 2 by the Camel Corps, as its garrison was being pursued by the Australian light cavalry. Bulfin followed up, occupying the coastal towns, Tyre, Sidon, Beirut. The advance of the Camel Corps and the cavalry, supported by armored cars, was unremitting. Following the railway they swiftly occupied Homs, Hamah, then Aleppo, the goal (Oct. 26).

Meanwhile, Marshall in Mesopotamia had found his progress checked by the Turkish Sixth Army strongly entrenched in a position astride the Fatha Gorge. A frontal attack would have been very costly, so the Turks were flanked on the left and forced to abandon their stronghold. The British next occupied Kirkuk, thus menacing their rear. Operations had opened on Oct. 23; within two days the Turks found themselves trapped. On Oct. 28 the British came in contact with the Turkish rearguard south of Kalat Shergat and drove up the Tigris. The Turks tried to break through in force but were repulsed. The Tigris to their west was now patrolled by British cavalry, and they were hemmed in by the British infantry on other quarters. They again attempted to break through during the night, this time on the north, but with no better results. They were gradually squeezed back as the reinforcements sent to them from Mosul were being dispersed by the Hussars. Without chance of relief or escape, the army was surrendered to General Cassels by Ismail Hakki at dawn, Oct. 30. The British resumed their advance on Mosul.

On that very day Turkey capitulated to the Allies, signing an armistice at Mudros, the headquarters of the Allies' fateful Dardanelles operations. Now the Allied fleet was free to occupy the forts which had cost so many lives, free to control the waterway to the Black Sea. Not long afterwards Generals Allenby and Franchet d'Esperey were to greet each other at Scutari and gaze triumphantly across the Bosporus at Constantinople, which they had enveloped by their great campaigns.

Colonial Campaigns.—One result of barring Germany from the seas was that she could render no assistance to the forces occupying her colonies, and was obliged to leave them to their fate.

Kiao-chou.—The Japanese had long coveted Kiao-chou (q. v.), the German protectorate in China, and their entry into the war on the side of the Allies presented them with a ready motive for action. On Aug. 15, 1914, Japan sent an ultimatum to Berlin, demanding withdrawal from the concession, and as no reply was received within the stipulated period of one week, declared war on Germany (Aug. 23). The presence of an Austrian warship in the harbor brought a war declaration from Austria (Aug. 25), but no active belligerent measures were undertaken by that country.

Tsingtau (q. v.), the capital, was defended by about 6,000 troops under Admiral Meyer-Waldeck, the governor. The harbor being strongly fortified, the Japanese decided on a land attack, and a corps of 20,000 men, under General Kamio, marched upon the stronghold from the rear. They were reinforced by British troops under General Barnardiston. The Japanese fleet, under Admiral Kamimura, and one British battleship blockaded the harbor and bombarded the city. Meyer-Waldeck made heroic resistance. Actual fighting began on Sept. 18, and by Oct. 1 the Japanese had reached the outer works of the port and seized positions dominating the city, which from now on was continually attacked by guns and air craft. A Japanese cruiser was sunk by a mine, and a German war vessel was torpedoed by the Japanese. On Nov. 6 a combined land and sea attack was made by the Japanese forces, now considerably augmented, and the Germans surrendered.

Oceania.—The German Samoan Islands, with the port of Apia, were peacefully occupied by an expeditionary force from Australia and New Zealand, accompanied by French cruisers, at the end of August, 1914. The conquest of German New Guinea and the Bismarck Archipelago was effected, with no resistance, by the Australian Naval Reserve under Commander Beresford on Sept. 12. On Oct. 5 a Japanese squadron seized the German island of Jaluit, in the Marshall group. Bougainville, the largest of the Solomon Islands, was taken by the British on Dec. 30.

Togoland, (q. v.), with an area of 33,700 square miles, between the Gold Coast and French Dahomey in West Africa, was the first German colony to be lost. Following the capture of Port Lome (Aug. 8), it was attacked on two sides by French and British troops, who finally joined their forces, and its small body of defenders surrendered on Aug. 27.

Kamerun.—The Cameroons, known to the Germans as Kamerun (q. v.), was equally unable to make an effective defense. Its sea coast was menaced by British warships, and in November British forces took Buea, the capital. Meanwhile French troops under General Aymerich were invading the coast lands, and by July, 1915, most of the interior had passed into the possession of the Allies.

Duala and Dehane fell in May and Garua, to the north, in June. Small bodies of German troops still held certain fortified posts, but they were for the most part isolated. Belgian troops from the Congo assisted the French in expelling the Germans from the thumb-shaped region through which flows the river Sanga (Oct. 29). Molundu was occupied on March 19, 1915, and Ngaundere, whither the Government had been removed (April 21), on June 29.

By Nov. 22 the French had occupied Tibati. On Jan. 18, 1916, the Germans abandoned Ebolowa, the German forces taking refuge in Rio Muni in Spanish territory, and resistance in the Cameroons was at an end.

German Southwest Africa.—The conquest of German Southwest Africa, begun late in September, 1914, was interrupted for over six months by a Boer rebellion in South Africa, which was started in the middle of October by Colonel Maritz and taken up by Generals De Wet and Beyers. The South African premier, General Botha, was able to crush this uprising after a short campaign, during which Beyers was drowned, and De Wet captured (Dec. 1). Early in February, 1915, Botha entered German Southwest Africa. Before this, a small South African force under General Van Deventer had man-

aged to recover the British territory of Walvis Bay (Dec. 25), which the Germans had taken, and on Jan. 14 had captured Swakopmund. Botha and Van Deventer now joined forces on the Cape border to the south and marched north through a difficult country, against the determined stand of the German defenders, toward Windhoek, the capital of the colony.

Windhoek was entered May 12, but a considerable part of the German forces managed to make their escape northward, and Botha went immediately in pursuit. The retreat turned into a flight, and on July 9 Governor Seitz surrendered the remaining German troops to Botha.

German East Africa.—Toward the end of September, 1914, a force from German East Africa invaded British East Africa, which bounded the former on the north. The object of invasion was the capture of Mombasa, the terminus of the Uganda Railway, but the Germans were held by a small body of Arabs and King's African Rifles—about 300 all told—until the arrival of Indian troops, when the invaders were defeated at Gazi and driven out of the country. The British forces now entered German territory, and attacked Tanga and Jassin early in November. Jassin was occupied, and then retaken by the Germans, Jan. 18–19, 1915. Tanga, an important coastal post, was able to resist capture. In the meantime British cruisers had made a raid on Dar-es-Salaam on Aug. 8. This was repeated in December. On Jan. 10 the island of Mafia, off the mainland of the German colony, was seized by British warships, and a blockade of the whole coast was declared on Feb. 28. In territory east of Lake Victoria Nyanza the British made some progress in minor operations which included an attack on Shirati (Jan. 9). Later the Germans crossed the line and captured Karungu and Kisu. Severely defeated at the former post in March, they abandoned the latter. Raids and counter-raids of a similar nature gave way in June to an expedition against the fortified port of Bukoba on the west shore of the lake. The attack was made by forces from two quarters, one from the Kagera River, just south of the Uganda, and the other on steamers from Kisumu. Upon their junction an assault was made on June 22, and the Germans and their Arabs were routed after a very stubborn resistance.

Belgium was operating with the Franco-British operations in Kamerun, as already mentioned, and also she was holding her own against the Germans on Lake Tanganyika (Oct. 24, 1914). Portugal, having declared herself the ally of England on Nov. 28, found herself forced to defend her African colonies. She succeeded in keeping the Germans out of Mozambique on the east coast; but in Angola, on the west, her border-guards were compelled to retreat before the invaders (Dec. 23). The occupation of her stations in Angola continued until early in February when, opposed by Portuguese reinforcements and threatened by Botha's operations in their own territory, the Germans gradually retired.

In the fall of 1915 General Smith-Dorrien of the Second Army in Flanders had been transferred to South Africa for the purpose of organizing and directing its forces against German East Africa, but he fell seriously ill in Cape Town and on Feb. 9, 1916, the supreme command was made over to General Smuts, leader of the Southern Army in German Southwest.

Modifying the plan of General Tighe, commander of the 1914–15 operations, General Smuts undertook as a preliminary the occupation of Moshi at the head of the Usambara Railway. A frontal attack was launched from Taveta, a border town, through a gap between Mt. Kilimanjaro (19,720 feet) and the Pare Mts, to the south, while General Stewart struck at the enemy's rear by a turning movement across the Longido Desert. The defenders were surprised and defeated, and Moshi was captured on March 13, thus enabling the British to rush the completion of the branch line between the German system and their own at Voi. The main column under Smuts now marched southeast on Tanga, subduing the highlands of Usambara and securing control of the railway and region between them and the Pangani River. Wilhelmsthal and Korogwe, important planters' centers, were occupied early in June, the German forces falling back on Pangani and abandoning the port of Tanga on July 7.

Meanwhile, a column under General Van Deventer, who had made a name for himself in the campaign against Southwest Africa, had been marching southwest to cut the Central Railway connecting the port of Dar-es-Salaam with Lake Tanganyika. A cavalry patrol had already pressed on west of Moshi and seized Arusha (March 20), when he began his daring advance across 300 miles of veldt. Kilimatinde, the old capital, was his objective. It was one long fight all the way through the Masai country; but in succession he occupied Kothersheim, Salanga, and Kondoa Irangi, the last on April 19, 1916. Here he met with a check and was shortly opposed by powerful reinforcements under General von Lettow-Vorbeck, whose counter-attacks (May 9–11) were finally repulsed and whose defeat was encompassed on July 28. The day following, Dodoma Station was captured, thus severing the main German communications and leading to the occupation of Kilimatinde not long afterwards.

In the east, Smuts possessed in Tanga an excellent harbor and base, had been moving down the coast on Dar-es-Salaam. Unfortunately, his main body was unable to catch up with the enemy who, pursued by an advance column, had succeeded in crossing the Lukiguru on June 24. With the aid of the navy, Saadani was occupied on Aug. 1. Smuts now endeavored to entrap the Germans in the Nguri Mountains, 80 miles west of this port. Failing this, he defeated them after a three-days' struggle (Aug. 9–11) at Matamonda, whence they were forced to retire toward Mrogoro. Van Deventer, in the meantime, had again come off victorious near Mpwapwa (Aug. 11), and by Aug. 21 engaged the Germans at Kilossa on the railway as Smuts was attacking it at Mkata, 20 miles further east. But the enemy escaped just as their two forces were joining hands, following the capture of Bagamoyo on the coast (Aug. 16). The British now pressed on through Mrogoro, taken on Aug. 26, after the fleeing Germans. The capital, Dar-es-Salaam, 'Harbor of Peace,' surrendered on Sept. 4, 1916.

During a corresponding period the colony was being invaded from four other quarters: (1) Rhodesia, by the British; (2) Congo, by the Belgians; (3) Uganda, by the British; and (4) Mozambique, by the Portuguese. On May 25 General Northey and his Rhodesians advanced from the line of the Stevenson Road which connects Lake Nyasa and Lake Tanganyika. His objective was New Iringa and immediate aim the control of the Livingstone Mts. New Langenburg, in the latter, was captured on May 30; Bismarckburg, on the southern end of Lake Tanganyika, on June 8. Old Langenburg soon yielded to his advance, and Ubena, east of the mountains, on July 1. With the fall of the lake ports Kala and Kirando, he was free to press on to the attack of New Iringa. At Malagali his prog-

ress was blocked by positions defended by the crew of the *Königsberg,* one of the cruisers which had escaped from Kiaochou, and had been sunk in the Rufiji River by British forces. These positions were seized after a fierce fight on July 24, and the Rhodesians marched on through Madibira and finally occupied New Iringa on August 29.

Five hundred miles to the north two Belgian columns under General Tombeur advanced on May 18 from either end of Lake Kivu and, spreading out fanwise, eventually served as a right wing to the British troops from Uganda. These, secure in their hold on Bukoba and the west shore of Lake Victoria were now clearing the eastern coast. The two contingents aimed to overtake Van Deventer's main body with a view to co-operating with him against the Central Railway. The Belgians compelled the retreat of the Germans near Kivu and occupied the Kama range of hills. By June 13 they were 125 miles in the interior, their left resting on the Kagera River, their center across the Akanyaru, and their right approaching Usambura (not to be confused with Usambara) at the head of Lake Tanganyika. The Allies now controlled the entire northwest. After defeating the Germans at Kiwitawe (June 22), the Belgians drove them towards Tabora. At Serayombo a considerable body of the enemy was taken prisoner. The capture by the British of Mwanza on Lake Victoria (July 14) ended all resistance in the north central zone. On Lake Tanganyika the last German gunboat, *Graf von Götzen,* was sunk by the Belgian, *Netta,* on July 28. Ujiji, the Lake railway terminus, fell to the Belgian right wing late the same month and shortly after Rutshug, some 60 miles to the east, was seized by the left, while a junction with Northey's outposts was effected upon the capture of Karema, a more southerly lake port, on Aug. 18. Tabora, Tombeur's main objective, was taken only after a severe struggle (Sept. 1–11). With the contingent of General Wahle in full retreat, all the west, as well as the north, was now in the hands of the Allies.

The Portuguese, in the meantime, had undertaken to hold the line of the Rovuma River, the boundary almost to Nyasa between the German colony and their own in Mozambique. Their operations began with the occupation of Kionga (April 11), taken from them by Germany in 1894. Their activities thereafter were limited mainly to harassing the German river posts with their gunboats.

There was now a lull on the east front. A half year of forced marches and continuous fighting under an equatorial sun was all that could be demanded of even the hardy South Africans; 12,000 men were sent back and replaced by the King's African Rifles and the Nigerian Brigade under General Cunliffe, who had served well in the Kamerun campaign. The next phase of the operations was the attempt of Smuts, Van Deventer and Northey to encircle the main German force retreating from Mrogoro before it could cross the Rufiji at Ruaha. The Portuguese now crossed the Rovuma to close the circle from the south, and by Nov. 4 were in touch with the British at Lindi. In the meantime, Wahle's army, pursued by the Belgians, had been driven south from the railway line and forced, on Oct. 22, into a running fight with Northey's flanking column. Smuts and Van Deventer, on their side, had been advancing from Kissaki since Dec. 11, and with the New Year, 1917, resumed operations against von Lettow-Vorbeck in the Rufiji Valley.

At this junction General Smuts was summoned to London to act on the War Council, the command going to General Hoskins, who was superseded in May by Van Deventer. In June the rounding up of the Germans was pursued relentlessly, but von Lettow-Vorbeck again slipped through the fingers of the British and crossed into Mozambique, followed by 320 white and 2,500 black troops and a large number of porters (Nov. 30).

Von Lettow-Vorbeck was to remain a thorn in the British side for the duration of the war. During its last year he led the Allies a chase which carried them at one time as far south as the Zambesi River. Doubling on his tracks early in September, 1918, he suddenly invaded the Songea region of the German colony. Headed off in that section, he swung westward into Rhodesia, attacking the border town of Fife on Nov. 2. Repulsed there, he retired west to Kasama due south of Lake Tanganyika. Half of his force was overtaken and defeated at Kayambi on Nov. 6 and another stiff fight occurred north of Kasama on Nov. 12 before news of the signing of the armistice could be communicated to the German commander.

The formal surrender was made to General Edwards at Abercorn, Northern Rhodesia, on Nov. 25. 'In view of the gallant and prolonged resistance maintained by the German force,' wrote General Van Deventer, 'I allowed General von Lettow-Vorbeck and his officers to retain their swords. . . . Thus ended a remarkable and in some ways unique campaign. Never before had operations on a large scale with modern weapons, taken place within a few degrees of the equator.'

War at Sea.—In its naval aspect the World War furnished a striking proof of the omnipotence of sea-power and a vindication of the adage that in the modern world the sea controls the land. The absolute control of the oceans of the world was complete by Christmas, 1914; the mercantile marine of Germany was swept from the seas, while her war fleets were for a long time restricted to 'cut and run' raids and the attempt to place armed raiders upon the trade routes. Isolated from transoceanic supplies the Central Powers were increasingly subjected to shortage of food and raw materials. The British blockade, partial at first, but growing in stringency as time went on, materially conduced to that breakdown of morale which characterized the final stages of the struggle.

The crisis of the naval war arrived when the German submarine campaign reached its height in 1917 and in the first quarter of 1918. The battles were of minor importance, and only that of the Falkland Islands was a definite victory.

In the first days of August, 1914, the British Grand Fleet sailed for a secret destination in or near the North Sea. The German fleet was gathered round the Kiel Canal. On August 28 an engagement was provoked in the Bight of Heligoland by Admiral Beatty's squadron. The German cruisers *Köln, Mainz* and *Ariadne,* and several destroyers were sunk or set on fire. Two British ships had to be towed back to port; all the others returned safely.

With the exception of a few cruiser raids upon the east coast of England, the German fleet attempted no offensive against the British. Yarmouth was shelled Nov. 3, and Hartlepool, Scarborough, and Whitby suffered considerable loss of life and property on Dec. 16. The next German raid started Jan. 24, but Admiral Hipper, with the armored cruisers *Seydlitz, Derfflinger, Moltke* and *Blücher* encountered Admiral Beatty's squadron—the battle cruisers *Lion, Tiger, Princess Royal, New Zealand, Indomitable,* and several destroyers —south of the Dogger Bank. The *Blücher* was sunk with 690 men, and the rest of the fleet sought refuge behind the mine

fields of Heligoland. The *Lion* was considerably damaged, and the total British loss was 42 (14 killed). After that Germany confined herself to submarine warfare against her powerful adversary. She had more success in the Baltic, where several successful engagements with the Russians occurred.

Before the entrance of Italy into the war, the Austrian fleet was practically inactive. Even the bombardment of Cattaro, begun Aug. 24, 1914, by an Anglo-French squadron, failed to draw it from its base at Pola. On Dec. 30, 1915, it undertook a raid on Durazzo, where Italy was concentrating a part of her expeditionary force to Albania, but was repelled with the loss of two destroyers.

In the Black Sea the Russian and Turkish navies became active in November, 1914. The Russians sank a number of Turkish transports in the harbor of Trebizond (Nov. 8), bombarded Eregli (Nov. 9), and severely damaged the transferred battle cruiser *Goeben* (Nov. 19). After December, the Turkish fleet kept close to the Bosporus, from which it made sudden excursions into the Black Sea.

The German Cruisers.—One of the most thrilling pages of naval history in the war is that which relates the adventures of a small number of German cruisers which happened to be away from home when hostilities broke out. Admiral von Spee, commander of the Pacific squadron, was at Kiao-chow with his flagship, the cruiser *Scharnhorst,* and the cruiser *Gneisenau,* while the light cruisers *Emden, Königsberg, Leipzig,* and *Nürnberg* were either there or within call. Two other light cruisers, the *Karlsruhe* and *Dresden,* were in the Atlantic; but owing to the effective patrol of the northern trade routes by British warships, they did not venture north of the Bahamas.

It was reinforced by four swift ocean liners converted into commerce destroyers—the *Kaiser Wilhelm der Grosse* and *Cap Trafalgar,* which slipped out of German ports, the *Kronprinz Wilhelm* from New York, and the *Prinz Eitel Friedrich* from a Chinese port. Two of these auxiliary ships came to speedy ends. The *Kaiser Wilhelm der Grosse* was caught and sunk by the British cruiser *Highflyer* off the west coast of Africa (Aug. 27); the *Cap Trafalgar* met the converted British cruiser *Carmania* off the coast of Brazil (Sept. 14), and was sent to the bottom. The *Prinz Eitel Friedrich,* after nearly nine months of successful preying on commerce in the Pacific and Atlantic Oceans, arrived in Hampton Roads, Va., on March 10, 1915. A month later the *Kronprinz Wilhelm* sailed into the same waters. Both these ships were interned.

The *Emden* appeared in the Bay of Bengal, Sept. 10, and within a week had captured or sunk six merchantmen. Captain von Müller continued his raiding until 70,000 tons of the Allies' shipping, valued at $11,000,000, was destroyed. Late in October (the 28th), the *Emden,* disguised by a dummy funnel and flying the Russian flag, entered the harbor of Penang, and escaped unharmed after sinking the Russian cruiser *Jemtchug.* About 35 miles out of port she met and sank the French destroyer *Mousquet.* On Nov. 9, the Cocos or Keeling Islands were sighted, and von Müller sent a detail ashore to destroy the British wireless telegraph station. While it was thus engaged, the Australian cruiser *Sydney* appeared; and von Müller had no time to recall his men. The *Emden* made for North Keeling Island, but was sunk by the *Sydney* before she could reach it. The men left on shore commandeered a small schooner, and, after many adventures, were picked up, in the course of a month, by a chartered German collier looking for the *Emden,* and landed on the shores of the Red Sea, whence they made their way to Constantinople.

The *Königsberg* went to the east coast of Africa, expecting to assist in the German expedition against Mombasa and British East Africa. On Sept. 20 she made a dash into Zanzibar harbor and sank the British cruiser *Pegasus,* which was repairing her boilers. On Nov. 10 she was discovered by the British cruiser *Chatham* hiding in shoal waters six miles above the mouth of the Rufiji River, German East Africa. She was finally destroyed in a fight with British river monitors, July 4, 1915.

Coronel.—Admiral von Spee sailed from Tsingtau in the *Scharnhorst,* and with the *Gneisenau* bombarded Papeete, the town of the French island of Tahiti, on Sept. 22. Presently he was joined by the *Nürnberg.* The little squadron, increased by the *Leipzig* and *Dresden,* then visited the west coast of South America, where von Spee found means of obtaining supplies. On Nov. 1 he unexpectedly encountered Admiral Cradock with two British armored cruisers, the *Good Hope* and the *Monmouth,* and the light cruiser *Glasgow,* off Coronel, Chile. Cradock, although outmatched in guns, offered battle, and was completely defeated in a two hours' running engagement. The *Good Hope* and *Monmouth* were lost with all on board. The more speedy *Glasgow* was able to escape.

Falkland Islands.—Upon the news of this disaster, a British squadron under Admiral Sturdee, consisting of the battle cruisers *Invincible* and *Inflexible,* the armored cruisers *Carnarvon, Cornwall,* and *Kent,* and the light cruiser *Bristol,* with a supply ship, was sent to join the *Glasgow* and settle accounts with von Spee, who was apparently heading for the South Atlantic. Sturdee sent a wireless message to the *Canopus,* an old battleship known to be in the neighborhood, to seek the protection of the guns of Port Stanley in the Falkland Islands. This was intended as a trap for von Spee. On Dec. 8, while the British squadron, which had arrived on the 7th, was coaling at Port Stanley, the lookout ship reported the approach of the German fleet. The action developed into three separate encounters. The *Invincible* (flagship) and *Inflexible* engaged the *Scharnhorst* and *Gneisenau.* The *Scharnhorst* caught fire and sank at 4 P.M., with Admiral von Spee and all on board; the *Gneisenau* went to the bottom at 6 P.M., and only 96 men were saved. Meanwhile, the *Kent, Glasgow,* and *Cornwall* started in pursuit of the *Leipzig, Nürnberg,* and *Dresden,* which had turned and fled in a southwesterly direction. The swift *Glasgow* got in firing range of the *Leipzig* at about 4 P.M., and held her until the *Cornwall* came up an hour later. Then she made for the *Nürnberg,* to hold her for the *Kent.* The *Leipzig,* under the *Cornwall's* fire, was sinking by 7 P.M., and turned over and disappeared at 9. Meanwhile, the *Kent* overhauled the *Nürnberg,* and she sank at 7:30 P.M. Two transports accompanying von Spee were also sunk by Sturdee's squadron.

The *Dresden* escaped until March 14, 1915, when she was discovered and destroyed by the *Glasgow, Kent,* and the auxiliary cruiser *Orama* at the island of Juan Fernandez, off the Chilean coast. This action cleared the high seas of all German warships, for the *Karlsruhe,* which had inflicted considerable damage to British commerce in the South Atlantic, destroying with the *Emden* some 165,000 tons, ceased to be heard from after November. It was announced by Germany two years later that she had been blown up by an internal explosion off the coast of Brazil and that the survivors, using a prize steamer, had escaped and returned to Germany by way of South America.

Submarines.—On Sept. 22, 1914, one of these vessels torpedoed and sank the British cruiser *Aboukir*, on patrol duty in the North Sea. Her consorts, the *Cressy* and the *Hogue*, coming to her assistance, met the same fate, with a total loss of 1,200 men. On Oct. 27 the battleship *Audacious* was sunk off the north coast of Ireland, and on Jan. 1, 1915, the battleship *Formidable* was sunk off Portsmouth by a submarine.

A month later the German undersea boats began their attacks on the merchant marine. England, in violation of international law, had declared a blockade on all contraband and conditional contraband; the Germans retaliated by proclaiming the waters around Great Britain a war zone, in which all commerce, neutral or otherwise, would be the prey of their submarines.

This campaign reached a climax on May 7, 1915, when the giant Cunarder *Lusitania* was sent to the bottom, and over 1,250 lives, including 114 Americans, were lost. This act, joined with attacks upon or the sinking of American vessels, elicited several notes of remonstrance and warning from the United States, but no satisfactory reply was forthcoming; and when the liner *Arabic* was torpedoed (Aug. 19), the tension between the two countries became still greater.

The Allies, outside of the Dardanelles, made little offensive use of the submarine, though the German cruiser *Undine* was sunk off the coast of Sweden in November, 1915. British undersea vessels had been acting with the Russian fleet; in another engagement in the Baltic, also off Gotland, in July, one of these had stolen upon the German battleship *Pommern*, and sunk it in a few minutes.

The Battle of Jutland.—On May 31, 1916, occurred the first and last great clash between the British and German battle fleets. This historic fight is treated under JUTLAND, BATTLE OF (q. v.). A great deal has been written about this indecisive battle, and criticism has been leveled at Admiral Jellicoe for not completely destroying the German fleet. Some British authorities have expressed the opinion that, if the German ships had been left alone they could have done no harm. The British Grand Fleet was only a few minutes in the battle, which was practically over before Jellicoe arrived. 'Admiral Jellicoe's method of deployment . . brought the Grand Fleet into action for a few minutes between about 6.20 and 6.35; and again between about 7.10 and 7.20' (*Brassey's Naval Annual*, 1924).

It has also been supposed that Jellicoe was under orders not to imperil his capital ships if avoidable, for a 'fleet in being' stronger than its enemy exercises pressure upon that enemy without firing a shot. The fact that the naval superiority of the Allies *existed* served to keep the oceans clear of German shipping, mercantile or war craft. After Jutland, to the end of the war, the German fleet remained in home waters.

Raids.—A raid by German battle cruisers was made on the English east coast towns of Lowestoft and Yarmouth on the morning of April 25, 1916; and on July 22 a German destroyer flotilla tried to operate against the mouth of the Thames but was pursued by the British and escaped.

The French auxiliary cruiser, *Admiral Charner* was torpedoed off Syria in February, and the battleship *Suffern* was sunk with her full complement, off Lisbon (Dec. 3). Russia twice bombarded Constantza, the Roumanian port after its occupation by von Mackensen (Nov. 2–4).

Submarine Warfare (1916).—Two Americans had been lost with the channel steamer *Sussex* on March 24. Upon the rather threatening protest of the United States (April 18), Germany agreed on May 5 to be guided thereafter by the laws of humanity. Ships would no longer be sunk without warning unless—the provisos were not easy of fulfilment. There was a slight lull in undersea activities; but on Oct. 8 the *U-53* sank six vessels off Nantucket Shoals while returning from a visit at Newport, R. I.

During this period Germany was augmenting her undersea flotilla and building still larger and more powerful types. Meanwhile she was experimenting with another type which was ostensibly to be used for commerce. In order to re-establish her trade with the United States she sent over the *Deutschland*, which made two trips and was then trapped by the British and secreted until after the cessation of hostilities. Great Britain had not been idle and was steadily perfecting methods with which to cope with the great menace to her sea-power. She was now endeavoring to catch the U-boats like fish, with nets of steel.

The Navies (1917).—With the United States' entry into the war, naval operations, while not undergoing any very radical change, were considerably lightened for the Allies by the cooperation, especially in the North Sea, of America's great fleet of superdreadnoughts and fast cruisers. Of even greater service, if possible, were her numerous flotillas of destroyers, a first squadron of which was in European waters on May 4, 1917.

Throughout the year there was the usual succession of Allied naval losses, casualties sustained through invisible agents, submarines or mines. Great Britain lost her battleship *Cornwallis;* auxiliary cruisers, *Laurentic* and *Hillary;* armored cruisers *Ariadne* and *Drake*—all in the order named—and a number of transports and three hospital ships. The chief misfortune for France was the sinking of her battleship *Danton*. On Dec. 6 the American destroyer *Jacob Jones* was torpedoed off the Scilly Isles by the *U-53*.

Submarine Warfare (1917).—On Jan. 31, 1917, the German Government threw aside all restraint and declared flatly for unrestricted warfare, as 'compelled to continue the fight for existence, again forced upon it, with the full employment of all the weapons which are at her disposal.' The zone was extended to surround Great Britain, Ireland, France, and Italy (see WAR ZONE). On the first day of the new campaign (Feb. 1) 10 ships, 113,000 tons, were sunk. Diplomatic relations with Germany were broken off by the United States two days later.

The cruising radius of the submarines was now materially increased, and their destructiveness to the shipping of the whole world was reaching alarming proportions. As a first step towards neutralizing the situation, President Wilson authorized the U. S. Shipping Board to take over the 87 German-owned ships interned in American ports upon America's entrance into the war (June 30). Already active steps had been taken to supply America with an adequate merchant marine and the Allies with a tonnage which would help to meet their losses. The Emergency Fleet Corporation set promptly to work establishing shipyards; but a long dispute regarding the relative merits of wood and steel ships delayed the program until its adjustment towards the end of July. Standardization became the order of the day and steel ships were soon on the ways and security seemed measurably assured. To safeguard these carriers, new devices were entertained for the deception of the enemy. By painting them with bands of variegated colors applied on scientific principles it was found possible to decrease their visibility, and produce illusions of direction which would

impair marksmanship (see CAMOUFLAGE). A Camouflage Corps was created to carry on this work, and England worked along the same lines. By the early part of 1918 the Atlantic was swarming with ships almost as gay in hue as the galleons of Spanish Armada days; but in spite of all precautions the sinkings continued. The total Allied and neutral losses for the year (though some of this was attributable to mines) amounted to over 1,264 ships, totalling 6,371,000 tons.

The German Sea Raiders.—Among the most amazing chapters of the war are the feats of Germany's raiders. Disguised as tramp steamers, their guns hidden by false forecastle heads, they waylaid peaceful and wholly unsuspecting vessels quite after the manner of the Dunkirkers of mediæval days or the Moorish corsairs, except that they did not make their captives walk the plank. Throughout the early winter of 1915–16 there had been rumors afloat of the operations of some new type of German craft; and when several merchantmen and the passenger steamer *Appam* from Africa to England became long overdue, it was an open question whether they had been sunk 'without trace' or captured by sea pirates. The latter proved to be the case, for on Feb. 1, 1916, the *Appam* steamed into Hampton Roads, Virginia. On board of her was a prize crew of 22 standing guard over the 429 souls taken from the 8 vessels a still nameless raider had captured and, barring the *Appam,* had sunk between Jan. 10 and Jan. 17. Only the last ship accosted, the *Clan MacTavish,* had tried to escape, with the result that she had been shelled with the loss of all but four of her crew.

The craft which had done all the mischief was the *Moewe,* a twin-screw steel steamer of about 1,200 tons burden. She was believed to have stolen out of Kiel and slipped through the British Grand Fleet—a correct surmisal. Her various captives were transferred to the *Appam* as their presence crippled operations and food was becoming scarce. A test case was made regarding the ownership of the *Appam.* Germany claimed her as a prize, but on July 29, 1916, she was awarded by the U. S. district court to her British owners, a decision later upheld by the Supreme Court (March 6, 1917). The *Moewe* slipped back home as cleverly as out, reaching Germany on March 5, 1916; but she reappeared in October, working down to the equator and back again once more, making her home port on March 22, 1917. During that period she added another 26 vessels to her list of victims. Among the crews she captured were 27 Americans of the *Esmeraldes.* These were brought to Germany and put in a prison-camp, where they were held till January, 1919.

Another raider, the *Wolf,* went even farther afield in her quest for prey. She was bent primarily on a mine-laying expedition along the coasts of the Indian and Pacific Oceans. To break the monotony of so long a voyage, she captured early in February, 1917, the *Turritella* and put on board a prize crew which was to lay mines off Aden. The last ship was unfortunate enough to meet a British warship. The German crew promptly scuttled their prize, and were taken prisoners. The *Wolf,* meanwhile, had made away with four more steamers. She was assisted in her work by a seaplane known as the *'Wölfchen,'* which served her like a falcon. The next game she encountered, the *Watunga,* she seized and with her made for a secluded harbor in Dutch New Guinea. Here the *Wolf* was careened. Then, after sinking her prize, she went venturing once more. On Sept. 26 she hailed the Japanese steamer *Hitachi Maru.* A fierce fight ensued in which the doughty Japanese suffered considerable losses. Her next victim was the Spanish ship *Igotz Mendi* (Nov. 10); her last, the Norwegian bark, *Storkbror,* early in January, 1918. The *Wolf* returned safely home after a voyage of fifteen months, bringing back with her more than 400 prisoners and a large quantity of loot. The *Igotz Mendi,* which she had fitted out for a raid on her own, ran aground on the Danish coast Feb. 24, 1918.

As extraordinary a series of adventures befell a third raider, the *Seeadler* ('sea eagle'). This motor-schooner stole out of Bremerhaven in December, 1916, passed the inspection of a British cruiser, and then with the aid of guns, concealed under a cargo of lumber, captured and sank 13 vessels before rounding the Horn into the Pacific, where she sank 3 American schooners and laid up for repairs on the atoll of Mopeha, 265 miles west of Tahiti (Aug. 1, 1917). During a shore picnic, a heavy swell broke the vessel's back. The commander was in a predicament. The rest of his activities in these waters belong almost to the field of romance. With five of his men, he was eventually captured by the Fiji local constabulary and interned in Auckland, New Zealand. In December he and his fellow prisoners escaped to sea in an open boat and travelled nearly 500 miles before they were recaptured. The rest of his original crew, who were operating an 'Island' prize, were finally brought to book in South America. Count von Luckner was the leader of this piratical death-sowing expedition.

The Zeebrugge Raid and Italian Naval Feats.—One of the most intrepid feats in the long history of the British Navy was the raid on the German submarine bases at Zeebrugge and Ostend in Belgium. Both had been repeatedly shelled by British monitors ,and bombed by Allied aircraft but to little purpose. On the night of April 22–23 (1918), a British naval force under Vice-Admiral Keyes advanced, hidden by a newly-devised smoke-screen. This concealed them until the light cruiser *Vindictive* was gradually swung alongside the great Mole through the efforts of the *Daffodil,* one of two Mersey ferryboats. About 25 minutes after her arrival the *Vindictive* was followed in by the *Thetis,* loaded with cement and leading the way for her two sister block-ships, the *Iphigenia* and *Intrepid.* The *Thetis* came to grief but the other two cruisers were sunk at the points selected, so that the main object of sealing the canal was attained. Shortly before this an old British submarine, containing high explosives, had worked her way under the viaduct joining the Mole with the mainland. While its daring crew of six were escaping in a skiff, the submarine blew up, and the viaduct and the Germans defending it were blown up. A thousand men volunteered for this expedition, which returned with casualties of 538 men and 50 officers, of which 144 and 16, respectively, had been killed.

At Ostend the block-ships *Sirius* and *Brilliant* were not so successfully placed; the experiment was repeated on the night of May 9–10, when the now very muchly battered *Vindictive,* well filled with concrete, was sunk between the piers and the channel partially blocked. The *Vindictive* was raised in 1920 and presented to Belgium.

Last Year at Sea.—By this time many new devices were in general use for the protection of the great warships, among them the ingenious paravane (q. v.), known as the 'otter gear' or 'P. V.' First employed only for the deflection of moored mines, it was finally developed as an agent for the offensive as well, and directed with considerable effect against submarines. At all events, the sinkings of Allied warships for the last year of the war were almost negligible, a cir-

cumstance to which American 'chasers' contributed greatly. Only a few transports and hospital ships are recorded as lost by the Allies; the American cruiser *San Diego*, which was sunk off Fire Island on July 19, being one of the unlucky few.

The American navy was now co-operating with the Allies overseas in patrolling the ever extending danger zones; and the combined forces were beginning to take a rich haul of *U*-boats. By this time the navigating charts of the waters around the British Isles were marked off into squares for the swift identification of the position of torpedoed ships or *U*-boats sighted by airplanes or surface craft. Later such observations were supplemented by listening-instruments which could locate an undersea craft to within a fraction of a mile. The point at which one of these submarines was supposed to be received depth bombs discharged by a 'Y' gun, another development of the war. A hit was easily recognized by the oil which must rise to the surface. In these operations the American submarine-chasers were an invaluable asset. Their principal bases were Queenstown (Cobh), Plymouth and Corfu, in the Ionian Sea.

To further extend her undersea operations, Germany now employed so-called 'mother ships' as fuel bases for a smaller type and sent submarines as far as the Western Atlantic for the purpose of laying mines along the shores of America. Towards the end of May one of the new cruiser type sank a number of vessels off the New Jersey coast. The sinkings continued off and on through the next three months from the Virginia Capes to Cape Cod. For a short period the port of New York was closed, but ocean traffic was soon resumed under convoy. One of the mine-laying submarines was the *U-117*, a craft some 275 feet long, which eventually fell to America's share of the surrendered fleet. Still larger craft were in existence. The *U-139*, which was turned over to the French, measured 354 feet long with a displacement of 2,900 tons. The British had in readiness one only 4 feet shorter when the Armistice was signed. As a preliminary to Germany's request for an armistice, her submarines were recalled to their home bases (Oct. 25).

On Nov. 21, 1918, Germany's great navy, comprising 9 battleships, 5 battle cruisers, 8 light cruisers, and 50 destroyers were surrendered to the Allies. In the bleak Orkneys they rode at anchor till June 21, 1919, when the large part of them was sunk, with colors flying, scuttled by their German crews.

Russian Aftermath.—Though Russia dropped out of the war soon after the Bolsheviki seized the reins in November, 1917, the country was not destined to enjoy peace for several years to come. Peace negotiations opened at Brest-Litovsk (q. v.) on December 30, when Trotsky invited the Allies to take part in the conference with Germany. Events moved swiftly in 1918. On January 1 the Soviet recognized the Finnish Republic; the 'Red Army' was created by decree of Feb. 9; the Soviet and the Ukraine made peace with the Central Powers on March 3; it was ratified at Moscow on the 16th; and on April 5 Japanese troops were landed at Vladivostok.

At Murmansk, on the northern coast of the Kola Peninsula, vast stores supplied by the Allies had accumulated. In order to prevent these stores from falling into the hands of the Germans and equally from the Bolshevik regime, the Allies sent a force of British, French, Serbs and the 339th U. S. Infantry Regiment. This move was also intended to encourage the 'White Russians' (anti-Bolshevik) to resist the new Soviet regime.

General F. C. Poole, British commander of the Allied forces, landed at Murmansk in April, 1918 and worked down the railroad line as far as Kandalaksha, thus protecting Murmansk. Next, he occupied the port of Archangel (Aug. 3). By this time detachments of Italians, Poles, Finns, Czechs, White Russians and Chinese refugees had swollen the ranks of the motley Allied forces, who spent a severe winter (1918–19) in that inhospitable region. Occupation of the two northern ports was continued until October 12, 1919, when the last of the Allies were withdrawn.

In the Far East the Allies were faced with another difficult problem. A small army of Czech and Slovak ex-prisoners of war in Russia had made a brave showing on the Volga and right through Siberia against both Germans and Soviet Russians. In order to assist these and to safeguard immense supplies of war material assembled at Vladivostok, an expedition was inaugurated. On Aug. 15–16, 1918, the 27th and 31st United States Regiments from the Philippines landed at Vladivostok, where the Japanese had already taken the matter in hand with British and French contingents. General William S. Graves commanded the American Expedition, but the supreme command was vested in the Japanese General Kikuzo Otani. Before long the eastern lines of the Trans-Siberian Railway were being operated by American engineers. The phases of the operations, the forces engaged and the political issues involved, fall outside the scope of this article, being on the whole an aftermath of the World War. See Russia: *History*.

The Toll.—A precise reckoning of the cost of the war in deaths, money and human misery is inestimable. Official figures of battle deaths and war expenditures are the merest indication of the tremendous losses due directly and indirectly to its ravages. Since, however, they constitute the only measure—however inadequate—of the cost of the conflict, they may be briefly summarized.

As computed by the U. S. War Department, corrected to June 30, 1928, the number of Allies killed in action or who died from wounds and disease were as follows:

Russia	1,700,000
France	1,357,800
British Empire	908,371
Italy	650,000
Roumania	335,706
United States	126,000
Serbia	45,000
Belgium	13,716
Portugal	7,222
Greece	5,000
Montenegro	3,000
Japan	300
Total	5,152,115

Like losses among the Central Powers were as follows:

Germany	1,773,700
Austria-Hungary	1,200,000
Turkey	325,000
Bulgaria	87,500
Total	3,386,200

Thus, the total loss among all combatants in killed and died amounted to 8,538,315. In addition, losses in wounded men, prisoners and missing for all combatants reached the huge total of 28,955,871, giving a gross total of all casualties of 37,494,186. In proportion to total mobilized forces, Austria-Hungary suffered the greatest percentage of total casualties, with 90%, and that country was followed by Russia (76.3%), France (73.3%), Roumania (71.4%), Germany (64.9%), Serbia (46.8%), Montenegro (40.0%), Italy (39.1%), British Empire (35.8%), Belgium (34.9%), Turkey (34.2%), Portugal (33.3%), Bulgaria (22.2%), Greece (11.7%), United States (8.0%) and Japan (0.2%).

Great Britain spent on the war more than twice as much as Ger-

many and Austria-Hungary combined, and more than all other of the Allied Powers put together excepting United States. The entire cost of the conflict has been roughly estimated at 345,471 million dollars, of which total the share of Great Britain amounted to 135,779 millions. The price paid by other combatants is estimated (in millions): Germany, $51,705; France, $39,811; Russia, $26,563; Italy, $22,163; Austria-Hungary, $20,432; Turkey, $2,259; Japan, $2,095; Belgium, $2,060; Roumania, $1,544; Bulgaria, $1,305; Portugal, $1,176; Serbia, $595, and Greece, $575.

The United States' financial burden in the war was heavy. For twenty-five months, from April 1917, through April 1919, that country spent considerably more than a million dollars an hour. According to the latest available estimate (1934), the total War Department expenditure on account of the conflict was $14,849,593,666. The total war expense of the Navy Department was $3,401,432,952 (aviation, $185,301,332; training stations, recruiting, etc., $95,514,380; ammunition, etc., $502,692,026; yards and docks, $212,751,628; fuel and transportation, $133,872,964; pay of the Navy, $613,134,005; provisions, 205,314,070; supply account fund, $143,276,476; construction and repair, $144,014,058; steam engineering, $134,095,304; U. S. Marine Corps, $165,049,397; new war vessels, $731,900,271).

Nor is this the whole story of United States participation in the war. According to Harold G. Moulton, Director of the Institute of Economics, Washington, D. C., the United States Government made loans to foreign nations between April 6, 1917, and Nov. 1, 1920, as follows, figures representing merely the principal of the obligations, without interest, in millions of dollars: Pre-Armistice war loans, $7,474.0; post-war loans, $2,091.8; bonds received in settlement for surplus war supplies, $574.9; loans for relief purposes, $84.1; loans by the U. S. Grain Corporation, $56.8. This huge amount of $10,281,600,000 was almost entirely spent in the United States; only an infinitesimal part went out of the country. Nor does this include the considerable sums borrowed in United States by Great Britain, France and other countries fighting Germany before America entered the war.

Two other items are not included in this total—$192,600,000 borrowed by the Russian Empire and repudiated by the Soviet government; and $24,000,000 loaned to Austria for food relief, the collection of which was postponed by act of Congress until 1942. Since Austria has been absorbed by Germany, that collection may remain problematical.

Territorial Changes.—In 1917, a year before the war ended, the Bolshevik revolution engineered by Lenin and Trotsky led to the establishment of numerous republics in what was once the Russian Empire. Except for Finland, Estonia, Latvia, Lithuania and Poland, these are now allied in the U. S. S. R. Germany became a republic; she lost Alsace-Lorraine to France, Eupen and Malmédy to Belgium, territory to Poland in the east; East Prussia was separated from West Prussia by the Polish Corridor. Germany west of the Rhine was for a time occupied by Allied troops; Danzig became a free city, and the northern part of Schleswig-Holstein reverted to Denmark by plebiscite. All the German colonies were taken away and mandated to Allied Powers.

The frontier between Poland and Lithuania may long remain in dispute, but otherwise the new states of Europe seem to be fully constituted. The Slavs of Bohemia, Moravia and Slovakia set up the Republic of Czechoslovakia; the Southern Slavs formed themselves into the confederacy of Jugoslavia. Austria-Hungary disappeared from the map and Austria was annexed by Germany in 1938. Hungary became a kingdom without a king, her territory much shorn by cessions to Italy, Czechoslovakia, Jugoslavia, Poland and Roumania, which last almost doubled her territory.

By a treaty signed in 1924 Jugoslavia handed over Fiume to Italy, which also holds the port of Zara and certain Adriatic islands off Jugoslavia. Greece gained territory in Thrace, where Jugoslavia is allowed access to the port of Salonika, and Bulgaria to Dedeagach, both on the Ægean Sea. Albania proclaimed herself a kingdom in 1928. Turkey in Europe was reduced to a fragment; its western frontier follows the Maritza River to Adrianople; in the north the boundary is about lat. 42° N. The seat of Turkish government was removed from Constantinople to Ankara (Angora) in Asia Minor. The Treaty of Lausanne (1923) provided for the demilitarization of zones adjoining the European frontier, the Dardanelles and the Bosphorus.

In few cases are the boundaries of post-war states geographically strong. France, by reaching the Rhine, lost the strong frontier of the Vosges. The boundaries of Poland are mainly ethnographical; those of Czechoslovakia both physical and ethnographical. By her large gain of territory, Roumania lost the strong frontier of the Carpathians. The separation of East Prussia from the remainder of Germany is a source of weakness, but all over there have been conflicting interests that have led to compromise in delimitation of boundaries.

Twenty Years After.—The belligerent nations entered the war from widely differing motives: to defend territory against aggression; to assert prestige; to enforce the sanctity of treaties; to take revenge upon enemies; and (as in the case of the United States), to oppose a 'natural foe to liberty.' From 1890 to 1914 the Kaiser had rattled the sabre, with the result that fear of Germany spread all over Europe, and when the war came, practically all the countries were against her. Even in the darkest days of the conflict, there developed in most minds a conviction that all outstanding issues between nations would be simultaneously and permanently composed—in fact, it was widely regarded as 'the war to end war.' The ardent belief that peace and amity were to be assured for posterity was perhaps the anodyne that drugged human senses to the appalling cost in life and treasure—it appeared to justify the heavy price that had to be paid.

Post-war treaties were expected to make the world safe for democracy; the erection of new frontiers in Europe would recognize the natural rights of minority racial groups to self-determination, and that the lives and possessions of the peoples would no longer be sacrificed by ambitious statesmen. Twenty years later, however, not only the people of Europe, but the whole world, had witnessed the absolute failure of all these hopes. International bitterness had grown more venomous even than it was in 1914, and far more men stood under arms than at the outbreak of the World War.

The League of Nations, from which so much benefit was expected, has also proved a disappointment; the same can be said of its offspring, the Permanent Court of International Justice; nor are the services of The Hague Tribunal much in demand. The United States Government rejected the Covenant of the League and did not join it. Soviet Russia spurned it for a time, and defeated Germany was at first excluded. Disarmament conferences failed to accomplish

any useful purpose. Peace pacts were eagerly signed—and promptly ignored. The Locarno Pact of 1925 had not yet been broken in 1938, though the Protocol, involving an agreement by all the signatories to co-operate in the furtherance of a general agreement regarding disarmament, had become a dead letter, and the Treaty of Versailles had been torn to pieces.

The world panorama looked gloomy indeed twenty years after the World War. A gigantic war was raging between China and Japan in the Far East; Spain was in the throes of a fierce, fratricidal civil war. In both those struggles innumerable noncombatants, men, women and children, were ruthlessly slain by artillery and aerial bombs. Germany had annexed Austria and Italy had conquered Ethiopia. The people of Europe stood trembling on the brink of another World War; all the great Powers were feverishly piling up armaments, strengthening armies, navies and air forces, besides fortifying their boundaries.

Events moved rapidly in Europe during the next two years. Czechoslovakia was dismembered by Germany in March, 1939. On Sept. 1, 1939, Germany invaded Poland, and on Sept. 3, England and France declared war on Germany. Defeated Poland was partitioned between Germany and Russia. Norway and Denmark were also invaded by Germany in April, 1940. On May 10, Germany invaded Luxembourg, Belgium, and the Netherlands. Italy entered the war on the side of Germany on June 10, and on June 17 France asked Germany for an armistice. Only England and her empire were left to fight it out with Germany and Italy. To Russia was ceded Bessarabia and Bukovina by Roumania in June, 1940; and in July, Estonia, Latvia, and Lithuania voted to become part of the Soviet Union. See WORLD WAR, THE SECOND.

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Euro'tas, the modern IRI, a river of Southern Greece, flows south in the valley of the Taygetus Range (ancient Laconia), empties into the Gulf of Kolokythia or Marathonisi, formerly the Gulf of Laconia. Ancient Sparta was on this river. Length, 50 miles.

Euryale, ū-rī'*a*-lē, one of the Gorgons, daughter of Phorkys and Keto, and sister of Stheno and Medusa (q. v.). With Stheno she attempted to take revenge on Hercules for the death of Medusa, the only one of the sisters who was not immortal. See GORGONES.

Euryale, a genus of the water lily family (Nymphæaceæ), of which there is only one species (*Euryale ferox*), sometimes called *Gorgon Plant,* found in China and Southeastern Asia. The leaves are circular, very large, and prickly; the flowers are small and purple; and the prickly fruit, which is about the size of a small orange, contains seeds used by the Hindus and Chinese for food.

Eurybia, the daughter of Pontus and Ge, and mother, by Crius, of Astraeus, Pallas and Perses.

Eurybiades, ū-ri-bī'*a*-dēz, Spartan commander of the allied Greek naval forces against the Persians in the Battle of Salamis (q. v.), in 480 B.C.

Eurydice, ū-rid'ī-sē. (1.) In Greek mythology, a nymph who married Orpheus (q. v.). After her death Orpheus induced Pluto to restore her to life, on condition that he should not look back at her until they reached the upper world. In his anxiety to see if she were following, he looked back just as they were reaching the upper air, and so lost her.

(2.) An Illyrian princess, mother of Philip of Macedon.

(3.) Granddaughter of Philip of Macedon, who was the center of many political intrigues about the succession to the throne after the death of Alexander the Great.

Eurył'ochus, one of the companions of Odysseus in his wan-

derings. He was the only one who escaped from the house of Circe (q.v.), the others being turned into swine.

Eurym'achus. (1.) Son of Leontiades, Theban commander at Thermopylæ, who deserted with his men to the Persians. According to Herodotus, he was killed (431 B.C.) by the Platæans while occupying their city with an armed force.

(2.) Son of Polybus, one of the boldest suitors of Penelope (q.v.). He was killed by Odysseus on his return from his wanderings.

Eurymedon, ū-rim'e-don, ancient name of a river in Asia Minor, now called Köprü-su, which flows through Pisidia and Pamphylia into the Mediterranean Sea. In 468 B.C. the Athenian general Cimon (q. v.) utterly defeated the Persians near this river.

Eurynome, ū-rin'ō-mē, in ancient mythology, one of the Titans, who with Ophion ruled over Olympus until they were dethroned by Zeus. She was the daughter of Oceanus, and the mother, by Zeus, of the Graces.

Euryp'ylus. (1.) The son of Euæmon, and one of the suitors of Helen (q. v.). He fought at Troy, where he offered to contend with Hector in single combat. Of the Trojan spoils he received an image of Dionysus, on the sight of which he was seized with a frenzy. A cure was promised by the Delphic oracle on condition that he dedicate the image where a barbaric sacrifice was made. At Aroë in Achæa, where a youth and a maiden had been sacrificed annually, he succeeded in substituting the service of Dionysus, and was cured.

(2.) The son of Telephos and Astyoche, sister of Priam (q. v.), a Trojan warrior who distinguished himself in combat with Neoptolemus.

(3.) King of Cos, son of Poseidon and Astypalæa. He was slain by Hercules, assisted by Zeus.

Eusebius, ū-sē'bi-us, OF CÆSAREA (*c.* 264–340), the 'father' of church history, was born in Palestine, and passed his youth mainly in Cæsarea. The great formative influence in his life was his friendship with a munificent and learned presbyter of that city, named Pamphilus; hence he is sometimes called *Eusebius Pamphili.* After his patron's martyrdom he fled to Tyre, thence to Egypt, and eventually gained the favor of the Emperor Constantine, and became bishop of Cæsarea (*c.* 313). He played a prominent part in the Council of Nicæa, acting as confidential adviser and amanuensis to the emperor; and he was the leader of the so-called semi-Arian or moderate party. That party was averse to discussing the nature of the Trinity, and would have preferred the language of Scripture to that of theology in speaking about the Godhead. Eusebius held that the promise of everlasting life was to him that believeth on the only-begotten Son, not to him that knows how He is begotten of the Father. He was very reluctant to accept the term *homoousios,* and retained kindly feelings toward Arius (see ARIUS).

Eusebius has the reputation of being the most learned father of the Church, after Origen and Jerome. His *Chronicon,* a history of the world down to 328 A.D., contains extracts from many writers whose works are no longer extant. His *Præparatio Evangelica* does the same; its complement is the *Demonstratio Evangelica,* in twenty books, ten of which are extant. His most important work is the *Ecclesiastical History,* in ten books (to A.D. 324), the great source for the period covered. Writings of less importance are *The Martyrs of Palestine,* the apologies against Hierocles and Marcellus, *Onomastikon,* commentaries, etc.

Eusebius OF EMESA (d. 360), a learned ecclesiastic of the school of Antioch, was born at Edessa in Mesopotamia, and studied under Eusebius of Cæsarea. His inclinations were Arian or semi-Arian. He declined the bishopric of Alexandria, vacant by the deposition of Athanasius, but was afterward appointed bishop of Emesa, in Syria. He was twice driven away by his flock, who accused him of sorcery on account of his astronomical studies. He was the adviser of the Emperor Constantius and the teacher of Diodorus of Antioch.

Eusebius OF NICOMEDIA (d. 342) was a relative of the Emperor Julian, and superintended his earlier education. His first see was at Berytus (Beirut), whence he was transferred to Nicomedia, and finally to Constantinople (339 A.D.). He was the leader of the extreme Arian party at the Council of Nicæa; and having unwillingly subscribed to the final resolution, continued both his support of Arius and his bitter hostility to Athanasius. He baptized the Emperor Constantine in 337. Athanasius considered him the disciple, rather than the teacher of Arius. See ARIUS.

Euskirchen, ois'kēr*ch*-*en*, town, Rhine province, Prussia; 25 miles by rail southwest of Cologne. It has cloth mills, tanneries, and chemical factories. Pop. 14,549.

Eustachian Tube, ūs-tā'ki-*an*, a narrow tube, lined with mucous membrane, and connecting the pharynx with the middle ear. It lies in the temporal bone, and by admitting air to the middle ear it preserves an equality of pressure on the inside and the outside of the membrane of the tympanum or drum. It is liable to be closed by catarrh, and its closure is soon followed by deafness of the affected ear, since part of the air in the middle ear is rapidly absorbed, with the result that the drum is rendered tense and incapable of vibration of the normal atmospheric pressure outside. See EAR.

Eustachian Valve, one of the valves of the heart, lying at the point where the inferior vena cava empties itself into the right auricle. See HEART.

Eustachio, ā-o͞os-tä'kyō, BARTOLOMMEO (d. 1574), Italian anatomist, was physician-in-ordinary to the popes, and professor of medicine in Rome. The tube in the auditory apparatus and the rudimentary valve in the heart which are called after him were carefully described in his *Opuscula Anatomica* (1564). His *Tabulæ Anatomicæ* contains a series of highly meritorious drawings from his own pencil. His plates and papers, supposed to be irrecoverably lost, were found to describe what were still new discoveries a century and a half after his death.

Eustathius, ūs-tā'thi-us (d. *c.* 1194), archbishop of Thessalonica from about 1166, was born in Constantinople. He was first a monk, and afterward a rhetorician; and was considered the most learned man of his time. His writings were principally on theological subjects; but his *Commentary on the Iliad and Odyssey of Homer* is valued highly. He also wrote commentaries on *Dionysius Periegetes* and *Pindar,* though the latter has been lost.

Eustatius Island, ū-stä'shi-us. See ST. EUSTACHE ISLAND.

Eustis, ūs'tis, JAMES BIDDLE (1834–99), American legislator, was born in New Orleans. He was admitted to the bar in 1856. During the Civil War he served on the staff of Generals Magruder and J. E. Johnston. In 1876 he was elected to the U. S. Senate, but, on account of political disputes in Louisiana, was not seated until three years later. In 1884 he was re-elected for the full term, and in 1893 was appointed Minister to France. In 1897 he took up the practice of law in New York City.

Eustis, WILLIAM (1753–1825), American legislator and physician, was born in Cambridge, Mass. He served as surgeon throughout the American Revolutionary War. From 1788 to 1794 he was a member of the Massachusetts legislature; from 1801 to 1805 a Republican member of Congress; and from 1807 to 1813 U. S. Secretary of War. He was Minister to Holland

(1814–18), and again a member of Congress (1820–3); and in 1823 became governor of Massachusetts.

Eutaw Springs, ū'tô, a locality in South Carolina, about 50 miles northwest of Charleston, near Nelson's Ferry, on the Santee River. It was the scene of the last serious battle of the Revolutionary War (see EUTAW SPRINGS, BATTLE OF).

Eutaw Springs, Battle of, the last pitched battle of the American Revolution, was fought on Sept. 8, 1781, by about 2,000 Americans under Gen. Nathanael Greene, against 2,300 British under Col. Alexander Stuart, commandant at Charleston. Greene forced Stuart along Eutaw Creek, well back toward the Santee swamps, which meant destruction; but the American troops, passing through the British camp, broke up to sack it, and the British rallied and drove them back again into the woods. Next day, Stuart retired to Charleston. The Americans lost, in killed and wounded, 408—Col. Wm. Washington being wounded and captured; the British lost 693. See REVOLUTION, AMERICAN.

Eutectic, ū-tek'tik. If a fused mixture of two minerals be cooled down, one of the components will begin to crystallize, provided the two components are independent or do not form mixed crystals. On further cooling a residue is at last left, in which the two components are present in definite proportions. Such a mixture has the lowest melting point of any which can be formed from these minerals, and was called a *eutectic mixture* by Guthrie, a Scottish physicist. On further abstraction of heat the eutectic mixture crystallizes as a whole. The composition of such mixtures is always the same at any given pressure. Eutectic mixtures play an important part in the constitution of alloys. Similar mixtures exist also among salts, and are known as eutectic salt alloys. Thus on cooling a solution of salt in water, either salt or ice crystallizes out, until the mixture contains 76.5 per cent. of water to 23.5 of salt at — 22° C., when it solidifies.

Euterpe, ū-tûr'pē (*i.e.*, 'she who delights'), one of the nine muses in ancient mythology. She was the muse of lyric poetry, and is represented with a flute in her hand.

Euterpe, a genus of tall, slender, tropical spineless palms, chiefly natives of tropical America. The leaves are terminal, and as the leaf sheaths completely fall with the rest of the leaf, the stems are clean and free from signs of previously dead leaves. They produce small white flowers, followed by purple pealike fruit. Among the species are *E. edulis*, the Assai Palm (q.v.), which reaches a height of nearly 100 feet, and *E. oleracea*, the Cabbage Palm (q.v.), which grows to a height of about 90 feet.

Euthanasia, ū-th*a*-nā'zhi-*a or* -nā'zi-*a*, an easy death, or a painless method of putting to death. The use of narcotics or other means for shortening life in disease is a subject of discussion in modern civilized countries; and it is often a debated question how far such means are admissible for soothing the last hours of life, when the approach of death does not itself dull the consciousness and the sensibility to pain. See DEATH.

Eutheria, ū-thē'ri-*a*, the highest class of mammals, including those in which there is a well-developed allantoic placenta connecting the mother and the unborn young. There is never a pouch (marsupium), nor are there marsupial bones; the brain is highly developed and well convoluted, especially in the higher forms. Among the Eutheria are included practically all the familiar mammals, for the other two sub-classes, represented by monotremes and marsupials (qq.v.), respectively, are chiefly found in the Australian region, only few marsupials and no monotremes occurring elsewhere. For the orders of Eutheria, see MAMMALS.

Eutropius, ū-trō'pi-us (d. *c.* 370 A.D.), Latin historian, filled the office of secretary to the Emperor Constantine, and fought against the Persians under Julian. His *Breviarum Historiæ Romanæ*, giving a short narrative of Roman history from the foundation of the city to 364 A.D., written in an extremely simple style, became very popular, was twice translated into Greek, and was continued by others down to the ninth century.

Eutyches, ū'ti-kez, archimandrite of a monastery at Constantinople, from whom the Eutychian controversy of the fifth century A.D. took its origin and name. In direct opposition to the Nestorians (q.v.), Eutyches maintained that in Christ there was but one nature, the divine, and that even His body was essentially different from the human. Arraigned for heresy before Flavian, patriarch of Constantinople, by Eusebius of Dorylæum, he was tried by a local synod (448 A.D.) and condemned. The Emperor Theodosius II. called an ecumenical council at Ephesus (449), which restored Eutyches. But the decision of this 'Robber Synod' (*Latrocinium Ephesinum*), as it was called because of the disgraceful violence which characterized it, was quashed two years later at the fourth ecumenical council at Chalcedon, which condemned the tenet of Eutyches, and formulated the doctrine of Christ's two distinct natures in one person, which has ever since been recognized as the orthodox position. Eutyches was subsequently banished. The Eutychian sect was from 452 put down by penal laws.

Euxenite, ūk'sen-īte, a brownish black, lustrous mineral, found in Norway, composed of the rare elements niobium, titanium, yttrium, erbium, cerium, and uranium.

Euxine, ūk'sin, the ancient name of the Black Sea, which is usually supposed to be a euphemism for *Axeinos*, 'inhospitable,' because of its stormy and treacherous character. See BLACK SEA.

Evagoras, ē-vag'ō-r*as*, king of Salamis, in Cyprus, from about 410 to 374 B.C. He was on friendly terms with the Athenians, and after the defeat of Conon at Ægospotami he afforded him hospitality. He secured the help of Artaxerxes II. of Persia for Athens against Sparta, and took part in the Battle of Cnidus in 394. After extending his conquests over the greater part of Cyprus, he crossed over to Asia Minor. The Athenians withdrew their support, and the Persians were jealous of his successes. Ultimately he was totally defeated at Citium, but took advantage of a quarrel between the Persian generals to conclude peace. In 374 he was assassinated.

Evagrius, ē-vag'ri-us (536–*c.* 610), a church historian, surnamed SCHOLASTICUS, was born at Epiphania, in Syria. It is supposed that he practised for some time as an advocate in Antioch; in later life he stood in high favor both at court and among the ecclesiastics. His *Ecclesiastical History*, a continuation of the work of Eusebius of Cæsarea, covers the period 431–594 A.D.

Evald, ā'väl. See EWALD.

Evander, ē-van'der, son of Hermes by an Arcadian nymph, called in Roman traditions Carmenta or Tiburtis. About sixty years before the Trojan War he is said to have led a Pelasgian colony from Pallantium, in Arcadia, to Italy, and to have built a town near the foot of the Palatine Hill, naming it Pallantium, after the one in Arcadia. Later it was incorporated with Rome. He did much to introduce the habits of social life among his neighbors: he prescribed for them milder laws, and taught them music and writing. Virgil represents him as being still alive when Æneas arrived in Latium after the sack of Troy. Evander was worshipped both at Pallantium, in Arcadia, and at Rome.

Evangel'ical, in its etymological import signifies accord with

the doctrine and spirit of the gospel. But the historic use and significance of the term have been varied. 'Evangelical' has been applied equally to the holders of Calvinistic and of Arminian principles. In the United States it is used to distinguish the more orthodox sects from those of liberal or rationalistic tendencies. In Scotland the party which opposed Moderatism was styled Evangelical. In England the evangelical revival left Wesleyan Methodism as its most conspicuous memorial. In Germany the term 'evangelical' differentiates Protestants from Roman Catholics. The Evangelical Church of Prussia became so named on the union of Lutherans and Calvinists in 1817, the tercentenary of the Reformation.

Evangelical Alliance, an association of Christians of different countries and denominations, founded in 1846, which aims at maintaining religious liberty throughout the world, relieving the persecuted in all lands, manifesting the unity of believers, and upholding the evangelical faith. It originated in a conference of English and Scottish ministers in Liverpool in 1845, and now includes branch alliances in Great Britain (the oldest and largest), Germany, France, Holland, Sweden, Denmark, Switzerland, Italy, Greece, the United States, Canada, Australia, Brazil, Mexico, and among the missionaries in Turkey, Egypt, India, China, and Japan. These various branches are related to each other as members of a confederation with equal rights. In addition to annual conferences and an annual week of prayer observed simultaneously in over 100 countries, international meetings have been held at London (1851), Paris (1855), Berlin (1857), Geneva (1861), Amsterdam (1867), New York (1873), Basel (1879), Copenhagen (1885), Florence (1891), and London (1896 and 1907).

The Evangelical Alliance of the United States was founded in 1867, and acts in concert with the British organization. *Evangelical Christendom*, a monthly organ of the Alliance, was published from 1847 to 1899, and continued as the *Monthly Intelligencer*.

Evangelical Association, a religious denomination founded among the descendants of German immigrants in Eastern Pennsylvania, in 1800, by Jacob Albrecht or Albright, a Methodist Episcopal preacher. In 1803 the church was organized under its present name, and the first conference was held in 1807 under a constitution similar to that of the Methodist Episcopal Church, having an itinerant ministry, presiding elders, and bishops, the last chosen for four years. The articles of faith embody the Arminian system of doctrine in Wesleyan form. The general conference meets every fourth year. Its founder was chosen the first bishop in 1807, but died the next year. In 1891 a division occurred in the church, and in 1894 a minority withdrew and formed the United Evangelical Church (q. v.).

In 1921 the Evangelical Association had 1,350 ministers, 1,850 churches, and 160,000 members. It has missions in Canada, Switzerland, China, and Japan. It conducts several educational and philanthropic institutions, and a publishing house, issuing in both the English and German languages. The official organ is *The Evangelical Messenger*, published in Cleveland, O.

Consult *Jacob Albright and His Colaborers;* Yeakel's *History of the Evangelical Association.*

Evangelical Church. See GERMAN EVANGELICAL PROTESTANT CHURCH; GERMAN EVANGELICAL SYNOD OF NORTH AMERICA.

Evangelical Continental Society, founded in 1845, was originally a branch of the London Missionary Society, but has long had a separate organization. It is the only Congregational society on the Continent; its object being to aid existing evangelical churches.

Evangelical Union, THE, a religious body formed in Scotland in 1843 by the Rev. James Morison of Kilmarnock, his father, and others, who separated from the United Secession Church. They were joined by ministers expelled from the Congregational Union for similar views—*viz.*, belief in the universality of salvation without distinction, exception, or respect of persons, and in the freedom of the human will. They revolted from the Westminster Confession and set up a modified independency, each church retaining its own form of internal government, Presbyterian or Independent. They have been identified with temperance reform, all their ministers being required to be total abstainers. They are also known as Morisonians, from their founder. In 1845 eight churches separated from the Congregational Union of Scotland and joined the Evangelical Union. In 1896 the Union was incorporated with the Congregational Union of Scotland. Consult the *Doctrinal Declaration* of the Union; Ferguson's *History of the Evangelical Union.*

Evan'gelist, the name given in the New Testament to an official of the Christian Church who seems to have stood midway between the apostles and the pastors and teachers (Eph. iv. 11). The function of the evangelist seems in the main to have been that of an itinerant missionary—one who had received the divine call and charism, as also the church's consecration. Philip the Deacon is called an evangelist (Acts xxi. 8), probably on account of his labors recorded in Acts viii. 5–40; also Timothy (2 Tim. iv. 5). In this sense, however, the official name seems soon to have fallen into disuse, being transferred to the writers of the four Gospels.

Evans, SIR ARTHUR JOHN (1851–), English archæologist, was born in Nash Mills, Hertfordshire. He made extensive archæological and ethnographical researches in the Balkans; excavated the prehistoric palace of Knossos from 1900 to 1908, and again in 1914, and there discovered archives in a pre-Hellenic script. In 1884 he was appointed Keeper of the Ashmolean Museum at Oxford, and in 1908 became Honorary Keeper and Extraordinary Professor of Prehistoric Archæology. He was President of the Society of Antiquarians (1914–19) and of the British Association (1916–19), and is the author of numerous archæological and numismatic works, notably *On the Coinage of Tarentum; Syracusan Medallions and Their Engravers; Tombs of Knossos; Scripta Minoa*, containing the unknown script; and *Palace of Menos* (vol. i., 1922).

Evans, AUGUSTA JANE (1835–1909), American author, was born in Columbus, Ga. She accompanied her parents to San Antonio, Texas, in 1846, and in 1849 to Mobile, Ala., where she wrote her first novel, *Inez, a Tale of the Alamo*, in 1850; although it was not published till five years later. This was followed by her popular story, *Beulah* (1859). In 1868 she was married to L. M. Wilson of Mobile. Later works were *Macaria* (1864); *St. Elmo*, the most successful of all (1866); *Vashti* (1869); *Infelice* (1875); *At the Mercy of Tiberius* (1887); *A Speckled Bird* (1902); *Devota* (1907).

Evans, EDWARD RATCLIFFE GARTH RUSSELL (1881–), British explorer, entered the British navy in 1897. He served on the relief ship to the *Discovery* expedition (1902–4), was second in command to Captain Scott in the Antarctic Expedition (1909–13), and succeeded to the command on Scott's death (1912). During the Great War, in command of the *Mohawk*, on the Belgian coast, he took part in the bombardment of the German right wing, and in 1917, when H.M. destroyers *Swift* and *Broke* engaged six German destroyers, he commanded the latter ship, which sunk two and torpedoed a

third. For this action he received the D.S.O., having previously been awarded the C.B. (1913).

Evans, FREDERICK WILLIAM (1808–93), American Shaker elder, was born in Bromyard, England, and came to the United States in 1820. He served an apprenticeship to the hatter's trade; afterward travelled extensively in the West; and becoming imbued with communistic beliefs, joined the United Society of Believers at Mount Lebanon, N. Y., and became a Shaker. In 1838 he was made an elder of the North Family, with whom he resided until his death. Elder Evans was a frequent spokesman for the Shakers, and induced them to modify their beliefs. He published *Autobiography of a Shaker* (1869); *Shaker Communism* (1872); *The Second Appearing of Christ* (1873).

Evans, SIR GEORGE DE LACY (1787–1870), British general, was born in Ireland. He served in India, the Peninsular War, and the United States, where he fought against the Americans at Washington, Baltimore, and New Orleans (1814–15); and afterward in Belgium, at Quatre Bras and Waterloo (1815). He was leader of the British Legion which rendered brilliant service to the Queen-Regent Christina of Spain against Don Carlos (1835–37). In the Crimean War he was wounded at the Alma, repelled the assault on Inkerman, and repulsed a sortie at Sevastopol.

Evans, HENRY CLAY (1843–1921), American legislator, was born in Juniata county, Pa. He enlisted in the Forty-First Wisconsin Infantry in 1864, and after the war settled in Chattanooga, Tenn., where he engaged in the manufacture of railroad cars and in the iron business. He became chairman of the board of education, and served two terms as mayor. He was a member of Congress in 1889–91, and was First Assistant Postmaster-General from 1887 to 1893. In 1894 he was elected Governor of Tennessee, on the face of the returns, but the election was not upheld by the legislature on a recount occasioned by the charge of irregularity in the balloting. He was Commissioner of Pensions in 1897–1902, and U. S. Consul-General at London in 1902–5. In April, 1911, he was elected commissioner of education and health for Chattanooga, Tenn., under the commission form of government, and served for one term.

Evans, HUGH DAVY (1792–1868), American author, was born in Baltimore. He became one of the most famous lawyers of his time, and is now chiefly remembered for his *Essay on Pleading* (1827), *Maryland Common Law Practise* (1839), his essays in support of the validity of Anglican orders, and his *Treatise on the Christian Doctrine of Marriage* (1870). He was a strong Protestant Episcopalian, edited several religious papers, and lectured on civil and ecclesiastical law in St. James's College, Maryland.

Evans, SIR JOHN (1823–1908), English archæologist and geologist, was born at Britwell Court, Buckinghamshire. He was actively engaged in the manufacture of paper as head of the Nash mills, and achieved distinction as a numismatist and antiquary. He was president of the Geological Society (1874–6); of the Anthropological Institute (1877–9); of the Society of Antiquaries (1885–92); of the Society of Chemical Industry (1892–3); of the British Association for the Advancement of Science (1897–8); and of the Numismatic Society from 1874 until his death. He published *Coins of the Ancient Britons* (1864), with *Supplement* (1890); *Ancient Stone Implements, Weapons, and Ornaments of Great Britain* (1872); *Ancient Bronze Implements of Great Britain and Ireland* (1881).

Evans, MARIAN. See ELIOT, GEORGE.

Evans, OLIVER (1755–1819), American inventor, sometimes styled the 'Watt of America,' was born in Newport, Del. He was apprenticed to the wheelwright trade, and early displayed the inventive genius to which were due the automatic flour mill, the first high-pressure steam engine, a machine for making card teeth, the first steam dredge, a boiler known as the 'Cornish boiler,' and an engine for the propulsion of river boats. These inventions, though of great importance, brought him small returns. His flour mill reduced the cost of labor one-half, and made a much finer grade of flour. His steam dredge propelled itself on a carriage to the Schuylkill River, near which it was built, and was the first instance of land travel by steam in America. He also planned a railroad between New York and Philadelphia. He wrote *Miller and Millwright's Guide* (1797); *The Young Engineer's Guide* (1805). Consult Thurston's *Growth of the Steam Engine.*

Evans, ROBLEY DUNGLISON (1846–1912), American naval officer, was born in Floyd county, Va. In 1859 he decided upon a naval career, and in order to secure an appointment to the U. S. Naval Academy, made the long trip to Utah, much of the distance on horseback, to establish a legal residence. He was graduated from the Academy in 1863; served as ensign on the steam sloop *Powhatan* in the North Atlantic Blockading Squadron (1864–5); and in January, 1865, took part in both attacks on Fort Fisher, being severely wounded in the second. In 1866 he was commissioned lieutenant; served on ordnance duty until 1870, and in 1873 went to the Mediterranean as navigating officer of the *Shenandoah.* In 1874 he became executive officer of the *Congress.* In 1878 he was made a commander, serving for four years as commanding officer of the training ship *Saratoga.* In 1881 he was equipment officer at the Washington Navy Yard, and a member of the First Advisory Board, which laid the foundations of the new steel navy. From 1882 to 1884 he was inspector of the fifth lighthouse district, and in 1887–9 was secretary of the Lighthouse Board.

Evans commanded the *Yorktown* at Valparaiso, Chile, in 1891–2, at a time when relations between the United States and that country were greatly strained. He arrived (October, 1891) soon after the attack by a Chilean mob on sailors of the U. S. S. *Baltimore,* and afforded the protection of his vessel to Chilean political refugees. His determined stand in the face of petty attacks and insults forced an apology from the Chilean government, and earned for him the sobriquet of 'Fighting Bob.'

He subsequently commanded the American fleet charged with preventing illegal sealing in the Bering Sea, capturing 98 of the 108 vessels known to have been engaged in the prohibited trade. He became a captain in June, 1893, and in 1894 assumed command of the cruiser *New York.*

In the Spanish-American War Evans commanded the *Iowa,* and took a conspicuous part in the naval battle of Santiago (July 3, 1898). Subsequently he was president of the Board of Inspection and Survey, and was made a rear-admiral in 1901. He was in command in the Far East in 1904. He commanded the fleet of sixteen American battleships that travelled around the world in 1907–08, from the time it left Hampton Roads until it reached San Francisco. He was retired on Aug. 18, 1908, and became an advisory member of the General Board of the Navy. He published *A Sailor's Log* (1901); *An Admiral's Log* (1910).

Ev'anston, city, Illinois, Cook county, on the shore of Lake Michigan, and on the Chicago and Northwestern, and the Chicago, Milwaukee, and St. Paul Railroads; 12 miles north of Chicago. It is connected by electric and elevated road with the latter city, of which it is a flourishing

residential suburb. Educational and public institutions include Northwestern University (q.v.), Evanston College for Women (1871), Garrett Biblical Institute, National Elementary Kindergarten College, Illinois Children's Home, City Library (costing $100,000), Evanston and St. Francis' Hospitals, and Grove Home for Convalescents. Evanston is the national and international headquarters of the Women's Christian Temperance Union. Pop. (1910) 24,798; (1920) 37,234.

Evanston, city, Wyoming, county seat of Uinta county, in the extreme southwest corner of the State, on the Union Pacific Railroad; 76 miles east of Ogden, Utah. It is situated in the Bear River Valley, in a coal and oil region. It has lumbering interests, coal and iron mines, and contains the shops of the Union Pacific Railroad. It is the seat of the Wyoming Insane Asylum. Pop. (1910) 2,583; (1920) 3,479.

Ev'ansville, city, Indiana, county seat of Vanderburg county, on the Ohio River, and on the Chicago and Eastern Illinois, Louisville and Nashville, Illinois Central, Big Four, Southern and Louisville, Henderson and St. Louis Railroads; 163 miles from St. Louis. The city occupies an elevated site on the north bank of the river; is regularly laid out, and has many fine business blocks and several parks. The U. S. Government and civic buildings are noteworthy, as are the Willard Library and Art Gallery, Marine Hospital, and Southern Indiana Hospital for the Insane.

Evansville is a large hardwood market, carries on an extensive trade in wheat, corn, flour, coal, and tobacco, and has many thriving industries, represented by furniture factories, flour mills, foundries, machine shops, planing mills, cotton and woollen mills and cigar factories. It is also the largest manufacturer of baby foods in the world. It is a centre of the soft-coal trade, having five mines within the city limits, and 52 within a radius of 50 miles. More soft winter wheat is grown here than anywhere else. According to the U. S. Census of Manufactures for 1937, there were, in Evansville, 171 manufacturing establishments employing 17,251 wage earners and having a total payroll of $19,516,978, and products valued at $188,308,542. Pop. (1920) 85,204; (1930) 102,249; (1940) 111,034.

Evansville, city, Wisconsin, in Rock county, on the Chicago and Northwestern Railroad; about 30 miles southeast of Madison. Here is located Evansville Seminary. Gasoline engines, pumps, wind mills, and butter are manufactured and there is a canning factory. Pop. (1910) 2,061; (1920) 2,209.

Evaporation, the change of a liquid into gaseous form (vapor), without chemical change. The process absorbs heat—*i.e.*, is an endothermic action. The heat which is absorbed or which disappears in evaporation, measured in heat units per pound, is the *latent heat of vaporization.* For water at atmospheric pressure it is about 970 British thermal units—*i.e.*, the heat consumed in converting a pound of water into vapor without change of temperature would raise 970 lbs. of water one degree in temperature. Evaporation is most commonly induced by heating, as in steam boilers, but it also goes on without heating (evaporation from rivers and lakes, etc.). Most solids (except those which decompose on heating) melt before vaporizing, and the subsequent vaporization is that of a liquid. Solids whose melting point is above their vaporization point change to vapor without melting when heated at atmospheric pressure; this kind of evaporation is called *sublimation* (q.v.).

When evaporation proceeds without artificial heating, the heat absorbed is drawn from surrounding objects. Thus, evaporation is a cooling process, and it is often utilized for this effect —*e.g.*, in sprinkling during hot weather; in spray-cooling of air in ventilation systems; in cooling-towers and cooling-ponds for reducing the temperature of condenser water in steam plants; and in making artificial ice.

Every liquid constantly tends to form vapor at its surface, and the vapor immediately in contact with the surface tends to recondense. The former action depends on the kind of liquid and on its temperature, increasing as the liquid is warmer; the latter action depends on the concentration of the vapor, increasing as the vapor density increases. For any given temperature of a given liquid, the re-condensation balances the evaporation as soon as a certain critical vapor density is reached, known as the *vapor tension* of that liquid at the given temperature. When the liquid is in the open air, the emitted vapor diffuses away, and thus cannot maintain at the surface of the liquid a concentration equal to the vapor tension; therefore the process of evaporation continues indefinitely. But if the space over the liquid is confined, the vapor accumulates, and soon reaches the vapor tension corresponding to the temperature of the liquid, when the (net) evaporation stops. The air (or other gas) in this confined space is then *saturated.* The vapor tension is independent of the presence of air or other gases, and is independent of pressure: *i.e.*, in a confined space containing a quantity of a particular liquid, the *partial pressure* of the vapor, measured in pounds per square inch, does not depend on the air pressure prevailing in the space, but only on the temperature.

The vapor tension, increasing with the temperature, becomes equal to atmospheric pressure at a definite temperature known as the *boiling point* of that liquid, when the liquid gives off bubbles of vapor from its interior (ebullition); for water this is at 212° F. In high altitudes the atmospheric pressure is lower than at sea level; hence a lower vapor pressure is required to equal it—*i.e.*, the boiling point is lower. Recorded boiling points are therefore given for standard sea-level barometer, 29.92 ins. or 760 mm. mercury (14.7 lbs. per sq. in.). The boiling points of some common liquids are given here. (See also BOILING POINT.)

BOILING POINTS AND LATENT HEATS OF VAPORIZATION (KENT).*

Liquid.	B. P., F.°	Latent Heat.
Sulphur	833	....
Mercury	676	....
Sulphuric acid	590	....
Nitric acid	248	....
Saturated brine	226	....
Water	212	†970
Alcohol (ethyl)	173	†378
Chloroform	142	....
Carbon bisulphide	118	†156
Ether	95	†163
Sulphur dioxide	14	†169
Ammonia	−27	†570
Carbon dioxide	−110	....

*All figures are for atmospheric pressure. † B. T. U. per lb.

In boiling, vapor bubbles form in the interior of the liquid; and evaporation proceeding at the surface of such a bubble, just as at the upper surface, the bubbles rapidly enlarge, rise to the surface, and discharge their vapor contents. The great multiplication of evaporative surface in this condition results in very rapid evaporation.

If the pressure on the liquid is reduced below atmospheric, the liquid boils at a temperature below the normal boiling point. By putting a dish of water at room temperature under the receiver of an air pump, and exhausting, boiling occurs when the pressure is reduced to the vapor tension of water at the temperature prevailing. Conversely, when the pressure is increased above atmospheric, supernormal temperature is required to produce boiling: *e.g.*, in the boiler of a steam power plant the tempera-

ture is well above 212° F., increasingly so as the pressure rises.

The latent heat of vaporization varies with the temperature. For water it decreases, as the temperature rises, by about 0.7 B.T.U. per degree Fahrenheit.

Evaporation is employed in the laboratory to separate dissolved solids from the liquids which contain them, either as simple evaporation or as *distillation*. For the former a shallow vessel is heated over an open flame, or, to prevent overheating, over a sand-bath or a water-bath. The water-bath is similar to the double boiler of the kitchen, the heat being transmitted by steam, so that the substance to be heated cannot get hotter than about 212° F. In open evaporation the dissolved solids are retained in the dish, but the liquid is lost. Distillation retains the liquid by leading the emitted vapor through a pipe to a cooler vessel, where it condenses. Retorts and stills of various shapes, with condenser bulbs or coils, are used in the process. (See DISTILLATION.) Chemical analysis requires the use of evaporation wherever solids are separated by solution and the fractions are to be recovered without chemical precipitation.

The heat required for evaporation is equal to the weight of the liquid multiplied by its latent heat in heat-units per pound, plus radiation and other losses, plus the heat required to raise the liquid from its initial temperature to the boiling point. When the cooling effect of evaporation is the objective, it is to be calculated as equal to the latent heat of evaporation, the heating of the liquid being usually negligible, as the temperature reached is well below the boiling point.

The largest industrial use of evaporation by artificial heat is in steam generation for power production or heating purposes. Water is heated in a strong closed vessel (the boiler), and after ebullition begins, the pressure in the vessel rises, because of the accumulation of steam, up to the limit set by the safety valve. The steam temperature is equal to the boiling point corresponding to the steam pressure.

Multiple-Effect Evaporation.—For distilling water to purify it for drinking purposes at sea, and for concentrating liquids containing dissolved substances as sugar, the efficiency of the fuel which heats the liquid is increased by using the vapor produced in one vessel to heat a second evaporator, the vapor of this one heating a third, and so on. The successive evaporators or 'effects' having progressively lower temperatures, the pressures in them are made correspondingly lower by vacuum pumps, in order to produce ebullition.

TEMPERATURE AND PRESSURE OF STEAM.

(Boiling point of water at various pressures. After Marks and Davis.)

Vacuum or pressure.	Temp.	Latent Heat.*
Vacuum of 28 ins. mercury	100°F.	1036
1 lb. per sq. in. absolute	101.8	1035
2 " "	126.1	1021
5 " "	162.3	1000
10 " "	193.2	982
14.7 abs. =0 gage	212	970
3 lbs. per sq. in. gage	221.4	964.3
(Above Atmosphere)		
10° " "	240.1°	952.0
30 " "	274.5	928.2
50 " "	298.0	911.0
75 " "	320.3	893.9
100 " "	338.0	879.8
125 " "	353.1	867.6
150 " "	366.0	856.8
175 " "	377.6	846.9
200 " "	388.0	838.0

*B. T. U. per lb.

Boilers for steam generation have attained rates of evaporation up to about 13 lbs. of water per pound of combustible, and up to 20 lbs. water per square foot of heating surface per hour (in ordinary boiler practice, only 2 to 3 lbs. per square foot of heating surface is reached). Multiple-effect evaporators have attained rates of 45 to 60 lbs. per pound of coal.

Equivalent Evaporation.—The efficiency of evaporation in boilers is expressed in terms of equivalent evaporation from and at 212° F. This is the evaporation that would be obtained if the feed water entered the boiler at a temperature of 212°, and were converted into steam at atmospheric pressure and without superheating. Engineers' handbooks give tables of *factors of evaporation* from which may be read, for any feed-water temperature and any steam pressure, the factor which will enable the equivalent evaporation to be computed from the actual evaporation.

FACTORS OF EVAPORATION.

Feed-Water Temperature	STEAM PRESSURE		
	100 lbs.*	150 lbs.*	200 lbs.*
40° F.	1.217	1.223	1.226
80°	1.176	1.182	1.186
120°	1.134	1.141	1.145
160°	1.093	1.099	1.104
200°	1.052	1.058	1.063

* Per square inch above atmospheric pressure.

Natural Evaporation.—Evaporation without boiling is an extremely common physical action, being met constantly in daily life —*e.g.*, in drying wet clothes. Evaporation from the skin and from the lung tissues into the air breathed has close relation to the life of the human organism. In sweating, the skin is supplied with moisture at an abnormal rate, and more rapid evaporation results, with increased cooling effect. Exposed woodwork absorbs water from the atmosphere (swells), or loses water by evaporation (shrinks), as the moisture content of the air is greater or less than normal. In general, natural evaporation into the open air depends on temperature, humidity of the air, and nature of the exposed surface. Rough or porous objects, which offer a very large evaporative surface (as wet cloths, which expose nearly the whole aggregate surface of their component fibres) lose water more rapidly than smooth, dense surfaces. If the air moves over the drying surface, evaporation is increased.

Evaporation is the chief method of drying, and is applied to this purpose in a great variety of ways, both in ordinary life and in industrial applications.

Evaporation of the Earth's Water.—Evaporation from the earth's surface supplies the atmospheric water, and thus is the source of rainfall. That proceeding at the surface of bodies of water (lakes, rivers, the sea) is largest in amount, but the ground and vegetation contribute materially to the total. As the vapor tension at winter temperatures is low, evaporation is rapid only in the summer months, the total for the four warmest months being half to two-thirds of the annual total. Some information on the monthly distribution of evaporation is given in the table herewith, containing averages for four points in the United States. However, the monthly distribution varies greatly for different localities.

MONTHLY EVAPORATION (PER CENT OF ANNUAL)

(Average of four stations in U. S.)

January	2.5
February	2.8
March	6.1
April	8.5
May	12.0
June	13.8
July	15 5
August	13.6
September	10 9
October	7 5
November	3.8
December	3.0

The annual evaporation in the United States varies from minimum values of 18 to 20 inches to maxima well above 100 inches depth of water. It is greatest in arid regions; increases with the proportion of exposed water surface in the district, and increases with the mean temperature. In the Salton Sink, California, evaporations up to

160 inches annual have been measured. Figures observed at 9 stations are here tabulated; they represent evaporation from water surfaces:

MEASURED EVAPORATIONS FROM WATER SURFACES

(Observations by U. S. Weather Bureau.)

PLACE	Annl. Evap., Depth in ins
Boston, Mass.	39.1
New York, N. Y.	39.6
Laramie, Wyo.	46.3
Fort Collins, Colo.	59.5
Fort Bliss, Tex.	82.6
Fort Douglas, Utah	42.5
Tucson, Ariz.	75.8
Clear Lake, Calif.	32.4
Sweetwater Reservoir, Calif.	57.5

A map of the United States, with lines of equal annual evaporation drawn on it, shows a maximum area extending from Key West diagonally to St. Louis (50 to 60 inches), and another covering Southern California, Nevada, Arizona, and New Mexico (90 to 100 inches). Along the Atlantic and Pacific Coasts the evaporation varies from 30 inches in the north to 50 in the south; the Missouri and Ohio Rivers outline the curve of 40-inch evaporation, higher annual evaporations prevailing south and west, except in the Puget Sound region, where low figures are found. In much of Europe the annual evaporation is 20 inches or less.

Evaporation from Land is too variable to permit of quoting representative figures; it depends on the amount of moisture in the surface soil, hence on the distribution of rainfall. Wind is also a factor, the evaporation in a moderate breeze being several times as great as that in still air. Vegetation has much influence, but this has not been studied sufficiently to give reliable figures. One estimate (Fernow) makes the relative evaporations as follows: from sod, 1.92; cereals, 1.73; forest, 1.51; mixed vegetation, 1.44; water, 1.00; bare soil, 0.60.

Water-supply problems are concerned with evaporation, as it reduces the run-off available from a given rainfall. Since both rainfall and evaporation vary with the region, run-off is more variable than either. In regions of moderate rainfall the mean annual run-off has been found to be about one-quarter to one-third of the precipitation, so that the evaporation is about 0.70 per cent. of the rainfall. In considering the storage of water in canals, reservoirs, and ponds, due allowance for evaporation becomes important; and as the critical water conditions occur in dry years, when the evaporation ratio will be abnormal, a maximum allowance should be made. Consult Turneaure and Russell's *Public Water Supplies;* Kent's *Mechanical Engineers' Pocketbook.*

Evap'orim'eter, an instrument for measuring the rate of natural evaporation, used in meteorological observation. The Piche Evaporimeter consists of a glass tube about 9 inches long, about ¾-inch internal diameter, closed at the top, and covered at the bottom with a piece of porous paper. The tube contains water, and the paper is kept wet by capillary attraction. A scale along the side of the tube permits reading off the height of the water column, from which, by subtraction, the evaporation in any interval of time is obtained. Experiments have shown (Russell) that the evaporimeter readings are one-third greater than the evaporation from open dishes of water at the same place. See also ATMOMETER.

Evarts, ev'erts, WILLIAM MAXWELL (1818–1901), American lawyer, statesman, and orator, the son of Jeremiah Evarts, missionary editor, was born in Boston, Mass. He was graduated from Yale in 1837; studied for a year in the Harvard Law School, and in 1841 was admitted to the bar in New York. His career as a lawyer was one of exceptional brilliance, and he eventually became a leader of the American bar. For many years he was the head of the famous law firm of Evarts, Choate & Beaman. Among the celebrated cases in which he was counsel were the Lemmon Slave Case, the Parrish Will Case, the Gardner Will Case, and the Tilton-Beecher Case, in which he was the chief counsel of Henry Ward Beecher. He was also President Andrew Johnson's leading counsel in the impeachment trial before the Senate (1868); was the leading counsel for the United States before the Arbitration Tribunal at Geneva, assembled to pass on the *Alabama* Claims (1872); and before the Electoral Commission (1877) argued with great ability in favor of Hayes. In politics Evarts was a Republican, and was an eloquent and effective campaign speaker. He was U. S. district attorney for New York (1851–3); a delegate to the National Republican Convention in 1860; Attorney-General of the United States in the Cabinet of President Johnson (1868–9); Secretary of State in the Cabinet of President Hayes (1877–81), and a member of the U. S. Senate (1885–91).

Eve. See ADAM AND EVE.

Evection, ē-vek'shun, the greatest lunar inequality, due to an alternate increase and diminution of the eccentricity of the moon's orbit according to the position of the perigee with respect to the sun. See MOON.

Eveleth, ev'e-leth, city, Minnesota, St. Louis county, on the Duluth, Missabe and Northern, and the Duluth and Iron Range Railroads; 70 miles northwest of Duluth. It is a residential city on paved highway No. 11 leading north from Duluth to the Superior National Forest. A high school and a junior college are the principal public institutions, and iron mining is the chief industry, employing 2,000 men. Between Ely Lake and St. Mary's Lake, three miles distant, is a tourist camp. Pop. (1910) 7,036; (1920) 7,205.

Evelyn, JOHN (1620–1706), English diarist, was born in Wotton, Surrey. In 1642 he went to Holland for three months and following the outbreak of the English Civil War spent four years in foreign travel. He settled at Sayes Court, Deptford, in 1652, and resided there until 1694, when he moved to Wotton, where he died. After the Restoration he was made a commissioner of the privy seal (1685–7), and treasurer of Greenwich Hospital (1695–1703). He wrote *Sylva, or a Discourse of Forest Trees* (1664), *Terra, a Discourse of the Earth* (1675), and a number of other works on a variety of subjects, but is remembered chiefly for his *Diary*, first published in 1818–19, which shows the graver side of the Royalist party with admirable force. Consult Wheatley's *Life*, prefixed to the sixth edition of the *Diary* (1879).

Evening Primrose. See ŒNOTHERA.

Evening Schools, schools provided for those who, for various reasons, are prevented from attending the ordinary day schools. These schools are either public or private, and in general are of three types: (1) those giving a repetition of the regular primary and secondary day school instruction; (2) those giving vocational instruction along industrial and commercial lines; (3) cultural schools for those whose daily work offers little opportunity along such lines.

In *Germany* evening schools are an important part of the continuation school system (see VOCATIONAL EDUCATION). In *England* they are administered as secondary schools, although elementary instruction is also provided. In *France* they are included in the department of primary instruction; the state makes an annual appropriation for their support, and subsidies are often granted by local authorities.

In the *United States* there are various agencies conducting evening schools, important among which are such private and semi-private institutions as Pratt in-

stitute and Cooper Union (qq. v.) in New York City; Drexel institute in Philadelphia; the Y. M. C. A., Y. W. C. A., and the Mechanics' institutes. The first free evening schools were established for negroes by the Society for the Propagation of the Gospel. In 1836 a free evening school was opened in Boston in the Warner Street Chapel. In Pennsylvania, an industrial evening school was established by the Moravians in 1754, and in 1850 the city of Philadelphia appropriated $2,000 for the establishment and support of free evening schools. In New York the Public School Society opened four evening schools for apprentices and others in 1833. These were soon discontinued, but in 1847 the New York legislature granted permission to the Board of Education to conduct evening schools for males and authorized $6,000 for that purpose. The following year evening schools for women and girls were authorized, and the appropriation was increased. Massachusetts authorized the establishment of evening schools in 1857, and in 1883 passed a law compelling towns of more than 10,000 to maintain elementary evening schools. Connecticut enacted a similar law, and various other States followed.

The first evening high school in the United States conducted by public school authority was opened in Cincinnati, O., in 1856; ten years later the first public evening high school in New York City was opened, and by 1870 there were at least five public evening high schools in the country. Since that time the number has largely increased. Under the Smith-Hughes Act of 1917 evening schools were granted funds for certain kinds of vocational education. Most cities have conducted evening schools since 1930.

See also EDUCATION; VOCATIONAL EDUCATION. Consult Sadler's *Continuation Schools in England and Elsewhere*; *Journal of Proceedings and Addresses* of the National Education Association.

Everest, ev'er-est, SIR GEORGE (1790–1866), British military engineer, was born in Gwernvale, Brecknockshire. He went to India as a cadet in the Bengal Artillery in 1806, and was there engaged in the improvement of the outlets of the Ganges. He subsequently took part in a survey of Java (1813–15), served on the trigonometrical survey of India (of which he was appointed chief in 1823), and was surveyor-general of India (1830–43). He wrote *Account of the Measurement of Two Sections of the Meridional Arc of India* (1847). Mount Everest (q.v.) in the Himalayas bears his name.

Everest, Mount, or CHOMO-KANDAR, a peak in the Himalaya Mountains on the frontiers of Nepal and Tibet; about 150 miles from the British border. It is the highest known peak in the world, its altitude as determined by trigonometrical measurements being 29,141 feet. It was named for Sir George Everest (q. v.), who first located it and measured its altitude. Until 1903, when Sir Francis Younghusband entered Tibet, no white man had even seen the peak except from India, where a complete view is obscured by mountains at its base; and up to 1921 no white man had been within 40 or 50 miles of it. The ascent presented tremendous difficulties, political as well as physical, but at length, in January, 1921, permission was obtained from Lhasa, the Forbidden City of Tibet, for a party of British mountaineers to attempt its ascent. The expedition was undertaken by the Royal Geographical Society and the Alpine Club, and in May 1921 the party left Darjeeling. In September six members with some 25 coolies made a camp at 22,320 feet. The intennse cold and weakened condition of the climbers compelled the abandonment of further attempts at that time, but the following year, early in June, the expedition reached 26,800 feet, the highest altitude ever attained by man. On June 27 the height of 27,300 feet was reached, but an avalanche caused the attempt to reach the summit again to be temporarily abandoned.

Everett, ev'er-et, city, Massachusetts, in Middlesex county, on the Boston and Maine, and the Boston and Albany Railroads; 3 miles north of Boston, of which it forms a residential and industrial suburb. Interurban lines connect it with Chelsea, Salem, Lynn, Malden, and other cities. It is comprised within the scope of the Metropolitan Parkway.

Everett has five miles of water front and the marsh lands along the railroads are partially developed. It has manufactures of shoes, gas and coke, chemicals, brooms, mittens, cars, bricks, paint and varnish, store fixtures and furniture, structural steel, steel castings, paper products, trunks, lathes, machine tools, and lithographs, as well as an iron foundry, oil refining plant, and felt mill. According to the Federal Census of Manufactures for 1929, industrial establishments numbered 115, with 6,375 wage earners, and products valued at $78,080,978. Pop. (1900) 24,336; (1910) 33,484; (1920) 40,120; (1930) 48,424.

Everett, city, Washington, county seat of Snohomish county on an arm of Puget Sound, and on the Great Northern, the Northern Pacific, and the Chicago, Milwaukee and St. Paul Railroads; 30 miles northeast of Seattle. It has several educational institutions, a Carnegie Library, Y. M. C. A., and two hospitals. With an excellent water-front, it is of growing importance as a deep-water port of the Northwest. The region is heavily timbered with fir, cedar, spruce, and hemlock, and there are rich deposits of precious metals. Industrial plants, according to the Federal Census of Manufactures for 1937, number 71, with a payroll of $4,222,349, and products valued at $21,317,418. They include iron furnaces, refining works, saw mills, shingle mills, furniture factories, brick yards, paper mills, machine shops, and shipyards. Lumber and shingles, flour, lead, paper, and creosote are shipped. The city was settled in 1891 and incorporated two years later. Pop. (1940) 29,975.

Everett, ALEXANDER HILL (1790–1847), American diplomat, elder brother of Edward Everett (q. v.), was born in Boston, Mass. He was graduated from Harvard in 1806; began the study of law under John Quincy Adams; and on the latter's appointment (1809) as U. S. Minister at St. Petersburg, accompanied him as private secretary, returning to Boston in 1812. He was secretary of legation (1815–16) and *chargé d'affaires* (1818-24) at The Hague; and from 1825 to 1829 was minister at Madrid. He then became a member of the Massachusetts State senate (1830); was sent on a confidential mission to Cuba (1840); was president of Jefferson College, La. (1842–4); and in 1845 was appointed a commissioner to China, where he died two years later at Canton. Among his publications, in addition to a great number of magazine articles, are *Europe, or a General Survey of the Political Situation of the Principal Powers* (1822); *New Ideas on Population* (1822); *America, or a General Survey of the Principal Powers of the Western Continent* (1827). From 1829 to 1835 he was owner and editor of the *North American Review*, to which he contributed.

Everett, EDWARD (1794–1865), American orator, political leader, and educator, was born in Dorchester, Mass., younger brother of A. H. Everett (q. v.). He was graduated with high honors at Harvard in 1811, and for a time was a tutor there. As pastor of the Brattle Street Church Unitarian in 1813–14, despite his

youth, he gained a wide reputation as a pulpit orator and as a controversialist, his book *Defence of Christianity* (1814) attracting particular attention. The work of the ministry, however, was not wholly congenial to him, and in 1815 he accepted the Eliot professorship of Greek at Harvard. To fit himself, he studied abroad for five years, spending much of the time with George Ticknor (q.v.), in Germany. They returned (1819) imbued with German ideals of scholarship, and introduced to some extent German educational methods—a significant fact in American educational history.

Everett held the Harvard professorship until 1824, and in 1820–4 was also editor of the *North American Review*, to which (then and later) he contributed numerous articles. From 1825–35 he was a Whig Representative in Congress, where he was a frequent and influential speaker, and a member of various important committees. In general he supported the administration of President Adams and opposed that of President Jackson. He was governor of Massachusetts in 1836–40, and as such was instrumental in establishing the State board of education. His attitude on slavery, however, greatly offended the Abolitionists in Massachusetts and elsewhere.

From 1841–5 he was U. S. Minister to Great Britain, at a time when relations between the two countries were strained owing to the McLeod Case, the *Creole* Affair, and the Oregon question. From 1846–9 he was president of Harvard College. He was then (November, 1852–March, 1853) the successor of Daniel Webster as Secretary of State in the Cabinet of President Fillmore; and from December, 1853, to June, 1854, when he resigned, was a member of the U. S. Senate. Thereafter he retired from political life, though in 1860 he was the candidate for Vice-President on the Constitutional Union (the Bell and Everett) ticket. (See CONSTITUTIONAL UNION PARTY.)

Everett's greatest reputation was as an orator. He spoke on numerous public occasions, his best known orations probably being the one on 'Washington' (which he delivered throughout the country in order to help raise funds for the purchase of Mount Vernon by the ladies of the Mount Vernon Association), and his Gettysburg Oration, delivered Nov. 15, 1863, at the dedication of the Gettysburg National Cemetery. As an orator he was extremely popular, but his oratory—elegant, graceful, polished, elaborate, often florid, carefully studied, and generally more or less artificial—was of a style which has long passed out of date. His orations were published in four volumes (1850–9). Consult *Memorial of Edward Everett;* Dana's *Address upon the Life of Edward Everett.*

Everglades, THE, a great marsh, about 90 by 50 miles, in the southern part of the Florida peninsula. Its eastern margin is within 5 to 10 miles of the Atlantic Coast; its western edge is 50 to 60 miles from the Gulf Coast. It embraces about 4,000 sq. m.; its surface is 10 to 20 feet above sea level. Lake Okeechobee (800 sq. m.), a fresh-water lake which drains an area of some 6,000 sq. m., but has no direct outlet, lies immediately north of the Everglades; and its flood waters, overflowing southward, are the chief supply of water to the Everglades. Its surface is 20 to 23 feet above sea level.

A canal cut in 1884 drains part of the lake waters through the Caloosahatchee River to the Gulf. South of this, the region west of the Everglades has extensive swamps (Big Cypress Swamp), but these are distinguished from the Everglades proper. A low ridge of rock, only a few feet higher than the general surface of the Everglades, extends southward along the western and eastern borders.

Half a dozen streams cut through the eastern rim to the Atlantic, and two or three through the western rim to the Gulf. The Everglades, within this rim, are a shallow, flat basin whose surface consists of water areas and mud flats, thickly overgrown with saw-grass (*Cladium effusum*), and occasional islands bearing palmetto and other trees and semi-tropical shrubs. The water is only 1 to 3 feet deep as a maximum; the bottom is vegetable muck and some sand, averaging 3 feet deep, lying on a flat plain of soft limestone whose surface is 8 to 10 feet above sea level. The Everglades muck contains some 70 per cent. of organic matter, and is high in nitrogen (2 per cent.). Agricultural experiments have shown it to be fertile when suitably drained and treated, with special advantage for sugar-cane culture.

Drainage of the Everglades has been agitated since shortly after 1840, and in 1850 Congress granted the area to Florida, the patent being issued only in 1903, however. A board of drainage trustees existed continuously in the interim, but progress toward draining the Everglades was made only since 1907, when the State took the work actively in hand. Earlier canals were cut from Lake Okeechobee west to the Caloosahatchee, and above the lake, to drain marshes around the lake. Recent plans involve a series of parallel canals from the Atlantic Coast northwesterly through the Everglades to the lake. The connection of Lake Okeechobee with this drainage system is to be such as to lower the lake level 3 to 4 feet. The main canals are 60 feet wide and 10 feet deep, and will have a total length of 200 miles. They are also intended to furnish waterways for the reclaimed lands. In the progress of the work 15,000 acres have already been brought under cultivation.

Consult articles in *Outing* (January, 1909); *World To-Day* (May, 1909); *Putnam's Magazine* (April, 1910); *Scientific American* (Jan. 21, 1911); *Cassier's Magazine* (March, 1911); *Everglades of Florida* (U. S. Senate *Document No. 89*, 62d Congress, 1911).

Evergreens are trees and shrubs which display a covering of foliage all the year round, as contrasted with the deciduous plants, whose branches are bare a part of the year. Evergreens are of two classes: the *coniferæ*, or cone-bearers, with resinous, needle-like foliage, as the pine, cedar, arbor vitæ, etc.; and the *sclerophyll* type, like the holly, laurel, box, rhododendron, etc.

Evergreens are invaluable to the landscape gardener of Northern countries for attractive winter effects. The coniferæ, grown in tubs, are highly desirable for house decoration indoors, as well as on porches and balconies; while their agreeable aroma is said to exert a beneficial effect upon the air of living rooms.

Everhart, BENJAMIN MATLACK (1818–1904), American botanist, was born in West Whiteland, Pa. He devoted much time to the study and collection of fungi and other cryptogamic plants. He helped edit the *Journal of Mycology* from 1885 to 1888, and with J. B. Ellis published *North American Fungi* and *North American Pyrenomycetes* (1892). Some of the principal American fungi bear his name.

Everlastings, or IMMORTELLES, are flowers which retain their form and much of their color for a long while after being picked and dried. They are frequently used in combination with dried ornamental grasses to make winter bouquets for home decoration. The most important are

the species belonging to the genus of composites known as Helichrysum, natives of Cape Colony and Australia. *H. bracteatum*, the ordinary garden va-

Everlastings.

1. Helichrysum bracteatum. 2. Acroclinium roseum. 3. Aphelixis macrantha.

riety, is one of the best. It bears large orange flower-heads, composed of dry bracts, though there are numerous varieties ranging in color from pure white to deep blood-red. *H. arenarium* is the species most frequently cultivated in France, under the name *Immortelles*. The flowers are naturally yellow, though they are usually bleached white and dyed in many colors to fit them for memorial wreaths. *H. grandiflorum* is a white-flowered species from Africa, often called Cape flowers.

The flowers are gathered on a dry day, and when they are partly open, but not so expanded as to display the centres. They are then tied in bundles and hung, heads downward, in a dry, cool room.

Several other species of garden flowers are prepared and used in the same way as Helichrysum.

In America, the wild native composites, all more or less white-woolly, belonging to the genera Antennaria, Anaphalis, and Gnaphalium, are known as everlastings. They have scarious involucral bracts—the latter two conspicuous in summer for their silvery flower-heads.

Eversley, CHARLES SHAW-LEFEVRE, VISCOUNT (1794–1888), Speaker of the British House of Commons, was born in London. He was called to the bar (1819), and in 1830 became M.P. for Downton, Wiltshire, being returned for Hampshire in 1831. In 1839 he was elected Speaker, and was re-elected in 1841, 1847, and 1852. Retiring from the Speakership in March, 1857, he was created Viscount Eversley of Heckfield. Consult Manning's *Lives of the Speakers*.

Evesham, market town and summer resort, Worcestershire, England, on the Avon, 15 m. southeast of Worcester, in a productive fruit-growing and market-garden district. Here a Benedictine abbey was founded in the eighth century; a fine tower and gateway still remain. The Town Hall is Elizabethan, and the Grammar School was originally founded in 1536. At Green Hill, to the north of the town, Simon de Montfort was defeated by the Royalists under Prince Edward on Aug. 4, 1265. An octagonal tower in the grounds of the Abbey Manor House marks the site of the battle. Pop. urban district, 8,341; parish, 12,307; parliamentary division, 53,239.

Eviction. In law, some act by a landlord which is considered to deprive the tenant of his possession or rightful enjoyment of the premises in question. It may be by process of law, or by rendering the premises uninhabitable in some way. See LANDLORD AND TENANT.

Evidence, the means sanctioned by law by which alleged facts are established or disproved in judicial proceedings. It is to be distinguished from argument based upon the facts, which can only suggest explanations of or inferences from them, and is not accepted as part of the proof.

Many rules have been devised by the courts to limit judicial discretion in the matter of receiving evidence, with the object of excluding everything which does not logically tend to prove or disprove alleged facts, or which is not introduced in such a manner as to render it safe and satisfactory proof. In general, all facts alleged and relied upon by a party to litigation must be proved by him if controverted by the opposite party; but the law permits judges, and juries under their instruction, to take 'judicial notice' or cognizance of certain facts which are considered either self-evident, or 'matters of common knowledge.' The limits of the discretion of judges in this regard have never been definitely fixed, and the courts are cautious, requiring proof when there is any doubt.

The methods of proving facts may be classified as follows: (1) by the testimony of witnesses; (2) by the introduction and authentication of documents containing matter relevant to the issue; and (3) by real evidence, or the production and inspection of an object which is part of the subject matter involved in a case.

Evidence may be *direct*, that is, a complete chain of facts tending to corroborate or establish the alleged facts in controversy; or *circumstantial*, which consists in the establishment of facts from which a logical inference can be drawn as to the truth or falsity of the facts in issue. For example, if A testifies that he saw B break into and enter a house and steal an article, this is direct and positive evidence; whereas if he testifies that he only saw B running from the house with the article in his hands, it is circumstantial evidence, as only an inference of theft can be drawn from his testimony. Both direct and circumstantial evidence are subject to the other rules of evidence.

It is as to the legal admissibility of evidence that most questions arise, and most rules exist. The law requires that the best or most convincing evidence possible under the circumstances shall be adduced, and the courts refuse to receive less satisfactory evidence, unless it is shown that the best is not obtainable. This is known as the 'best-evidence rule.' For example, the primary or best evidence of a letter and its contents is its production. However, if it is not obtainable, and this is proved satisfactorily, the court would allow secondary or parol evidence of its contents to be introduced. If a document is in the hands or under the control of the opposite party, the party desiring to prove its contents should serve a notice upon his opponent demanding its production at the trial; and if the latter neglects to comply with this request, on proof of the fact the court will allow secondary evidence of its contents.

Another general rule is that parol evidence cannot be introduced to vary the terms of a written instrument, but only to explain it. For example: if a will contains a bequest to A. B., a contestant cannot introduce evidence tending to show that this was a mistake and the testator meant C. D.; but he could show which A. B. was meant, if there are two persons of the same name who might have been in the testator's mind.

Certain presumptions may be based upon facts proved, which have the effect of evidence until rebutted. Thus it was held that where a person was shown to have been insane a short time

before an occurrence in issue, it would be presumed that he continued in that state in absence of evidence to the contrary. Another example of a legal presumption is, where it is shown that an accused person hired a witness to leave the jurisdiction, it will be presumed that the latter's testimony would be unfavorable to the accused.

It is a general rule that unsworn statements of a person may not be repeated by a witness on the stand. This is known as the 'hearsay rule.' The objection to such testimony is that it is not entitled to much weight, as the statements were not made under the solemnity of an oath (q. v.) and may have been carelessly made, and the person making them was not subjected to cross-examination. However, the difficulty of proof in certain classes of cases has caused the courts to make a number of recognized exceptions to this rule. One of these is the '*res gestæ* rule,' under which exclamations or unpremeditated statements made by a party to a transaction at the moment it happens, or, in some States, very shortly afterwards, may be admitted, as a part of the transaction. For example, where a person who had been stabbed said, about twenty seconds after the occurrence, 'I'm stabbed, D stabbed me,' it was held that this was a part of the *res gestæ* and admissible. By another exception admissions or declarations against the interest of the person making them can be proved by the testimony of another person who heard them, provided the declarant is a party to the proceeding. The confession of an accused person is admissible under certain conditions. (See CONFESSION.) Declarations of a dying person, who realizes his condition, as to the cause of his death, may be admitted in a trial for the murder of the declarant. The statements of a testator as to the contents of his will may generally be admitted if the will is lost and it is necessary to prove its contents. 'Declarations as to pedigree' constitute another exception to the hearsay rule. To be admissible, however, the statements must have been made by a disinterested blood relative or husband or wife of the person whose pedigree is in question, before the question in issue arose, and the declarant must be dead at the time his statements are proved. Declarations made by a deceased person who lived in a certain region for a long time as to the location of boundaries, highways, etc., are admissible in absence of better evidence.

Evidence as to the character of an accused person may not be offered by the prosecution, unless the defence offers some evidence on that subject.

In general, an ordinary witness is not permitted to give his opinion of anything connected with the issues; it is for the jury to draw inferences from the facts. However, it is common to call 'experts' to give their opinions in cases where the jurors are not well qualified to grasp some matter of technical knowledge in issue. For example, if it was alleged that A was poisoned, a medical expert would probably be required to examine his stomach, etc., determine the cause of death, and testify as to his opinion. An expert witness must be qualified, that is, his learning and experience must be shown to render him competent to form an intelligent opinion on the subject in question. The practice is to ask the expert hypothetical questions, based upon the facts assumed to be proved in the case. The weight of his testimony is for the jury to determine.

Where possible, anything involved in the issues of a case is produced in court, so that the jury may inspect it. Thus, clothes may be tried on before a jury where the question of whether they fit the person for whom they were made, is involved. An injured limb may be exhibited to a jury in a negligence case, or a portrait where the defence is that it is not a likeness.

Entries made in books of account are admissible under certain conditions. If made in course of duty by a person since deceased, they are admissible upon proof of his handwriting; if by the party who offers them he must swear to their correctness, and in some States he must prove a course of dealing with the other party; that he kept no clerk; that other persons had dealt with him and found his accounts correct; and that some of the articles charged were delivered, or items of service rendered by him. The contents of a public document may be proved by an authenticated copy.

The burden of proof of facts alleged is upon the party who alleges them. This rule is so rigidly enforced that if a plaintiff who has a good case to which there is no valid defence, fails to prove in court the facts constituting his cause of action, judgment will be entered for the defendant. The burden of proof never shifts, but the burden of evidence may do so in the course of a trial. For example: after the plaintiff has introduced in evidence facts making a *prima facie* case, the burden of evidence is shifted to the defendant to disprove or explain the testimony as to such alleged facts.

The matters of the competency and privileges of witnesses are also regulated by the rules of evidence. At early common law a witness could not testify unless he was a believer in the Christian religion, as otherwise it was not considered that an oath would bind his conscience. At present, however, an unbeliever may solemnly affirm that he will tell the truth, and his testimony will be received, its credibility being left to the jury. A child old enough to know the difference between right and wrong, and having some understanding of the nature of an oath, may be a witness. A person convicted of crime may be called as a witness in most jurisdictions. A physician and patient, minister of religion and parishioner, attorney and client, are each entitled to the privilege of refusing to testify as to matters disclosed by confidential communications in their relations as such. A witness is privileged from testifying as to any matter which tends to incriminate him, that is, render him liable to prosecution for crime. The testimony of a husband or wife will not be received against the other as to the commission of adultery, in an action for divorce, or as to matters disclosed in their confidential relations as such, but otherwise they may testify for and against each other.

A party may not directly impeach the credibility of a witness called by himself, and may not ask leading questions, that is, questions suggesting the answer by their form, of his own witness. However, he may do both in cross-examination of his opponent's witnesses. Consult Stephen's *Digest of the Law of Evidence* and Greenleaf's *Treatise on the Law of Evidence*. See TRIAL; WITNESS.

Evidences of Christianity. See APOLOGETICS.

Evil may be generally defined as that which is opposed to the divine order of the universe. Every form of religion testifies to the recognition of evil in the external world, and superstition in all its shapes mainly rests upon it.

Existence of evil is one of the perennial problems of theology and of philosophy—the problem how to account for, and what to infer from, the existence of evil in the world, especially that evil which does not depend upon the individual human agent, and under which, therefore, he may suffer without fault of his own. According to the significance attached to evil, a philosophy inclines to an optimistic or a pessimistic view of the world, or attempts to compromise between them. For an extreme

stoicism or asceticism the problem largely disappears, since the only evil recognized as such is the vice or sin of the individual, for which he alone is, from a moral point of view, responsible. But such a position is too harsh and paradoxical to afford any real solution. On a pessimistic view (see PESSIMISM), evil belongs essentially to the very nature of human life, or, indeed, of the whole present order of things, and the only deliverance for man lies in resignation, in the abandonment of a fruitless struggle.

The theories of compromise seek to explain evil as being due to the presence of some definite evil principle that wars against, or some refractory element that obstructs, the triumph of the good. They are thus dualistic. Such dualism is exemplified in the Manichæan heresy, and in modern times was regarded by J. S. Mill in his *Essays on Religion* as a natural and plausible explanation of the mixture of good and evil in the world. On this basis evil may be explained as that imperfection which the parts of a system necessarily appear to have when viewed in separation from the whole to which they belong—an imperfection, therefore, which is imputed by our ignorance. Or, again, evil is no positive reality, but only that privation or absence of the highest perfection which necessarily attaches to all finite existence as finite. The most famous philosophical defence of optimism on these lines is that given in the *Théodicée* (1710) of Leibniz.

Evil Eye, the power of exerting an evil influence or fascination on any one by a glance from the eyes, one of the most venerable and widespread of human beliefs, sanctioned alike by the classical authors, the Fathers of the Church, mediæval physicians, savage races everywhere, and modern usage in many countries within the range of Christianity. Especially powerful is the belief among the Neapolitans, and to raise the cry '*jettatore*' in Naples is to cause a panic.

Various devices are used as a protection against the evil eye. The ancient Egyptians painted a huge eye on the bows of their vessels; wax and silver eyes are hung up in many foreign churches; and amulets of all sorts are worn, the most common being horns in one form or another. Certain positions and gestures of the hand are also employed to ward off the evil eye; one such being to extend the index and little fingers, with the two middle fingers flexed and clasped by the thumb, making a crude imitation of the head of a horned animal. Consult Elworthy's *The Evil Eye;* Maclagan's *The Evil Eye in the Western Highlands;* Park's *The Evil Eye and Other Essays* (1912).

Evil-Merodach, ē'v'l mer'ō-dak (Assyr. *Amel-Marduduk,* 'servant of Merodach'), king of Babylon, 562–560 B.C. According to 2 Kings xxv. 27–30, he displayed great kindness to Jehoiachin, the captive king of Judah; but this act contrasts strikingly with the very adverse estimate of him given by Berosus. In 560 B.C. he fell a victim to a conspiracy headed by his relative Neriglissar.

Evolute. See CURVE.

Evolution, literally an unfolding, a gradual development from a simple or crude beginning to a more complex or complete form. In this sense the term evolution has a wide application, and we speak properly of the evolution of such diverse developments as the steam engine or locomotive, a political party, or a system of philosophy or religion.

In connection with the natural world, however, evolution has come to possess a special significance. As opposed to the doctrine of special creation, which teaches that things were made or created by some supernatural being or force, unlike the agencies now at work in the natural world—the doctrine of evolution teaches that the present order of things is the result of natural forces operative in the remote past as they are at the present time. It does not, however, preclude a specific creation of a rudimentary form by a first cause. While this theory of evolution applies equally to organic and inorganic matter, it is probably used more commonly in connection with the development of living forms, and it is in that sense that it is dealt with in the present article.

The theory of organic evolution is the theory that all forms of life are derived, by gradual modification, from earlier and simpler forms, or from a single rudimentary form. This conception may be said to contain the following elements: (1) A series of distinct forms or types (viz. the species of animal life) exists, representing definite stages in the process of evolution; (2) these forms are joined together as stages in a continuous process of change which a principle or substance fundamentally the same in all the forms (viz. protoplasm, or, more strictly, animal life, however that may be defined) undergoes; (3) the process of change is determined by the intersection of the given principle with its given environment; (4) the process of change may be regarded as a process of approximation to a highest or latest type (viz. man).

The evidences of evolution are sought by its advocates in the study of comparative anatomy and of comparative embryology, in the nature of fossil remains, and in the phenomenon of geographical distribution. A study of comparative anatomy, they hold, reveals the fact not only that certain great groups of animals, as the mammals, reptiles and birds, exhibit certain fundamental characteristics indicative of a common ancestry, but that the basic characteristics of each group can invariably be traced back to a group lower in the scale of animal life. No other doctrine, the scientist claims, so reasonably explains the great similarities and minor differences to be observed in the various groups of animals, as the doctrine of evolution—that is, descent from a common source, with adaptive modification.

The evidences of comparative anatomy are borne out by a study of comparative embryology, which reveals the fact that the development of the individual organism recapitulates in brief the history of the species as determined independently by anatomical study, the highly organized mammal beginning, like the simple hydra, as a single cell and passing through successive stages of development which duplicate essentially, if not exactly, those of the reptiles, birds, and amphibians.

The evidences of palæontology differ from those of comparative anatomy and embryology in that they are drawn directly from the past. Fossil remains, incomplete as they are, indicate the existence in prehistoric times of many groups of animals not known to-day and yet displaying marked similarity of structure to present species, while a study of the geological formations in the order of their age clearly indicates that the simplest forms belonged to the earlier epochs, while the more highly developed organisms were of later development. Thus, the fishes, which were the highest form of life in the Silurian and Devonian epochs, were superseded by the amphibia in the Carboniferous age, and these in turn by the great reptiles—the dinosaurs and kindred forms—of the Mesozoic Age, which were followed by birds and mammals approaching our own present-day species. Fossil remains of individual species also tell the story of the development of the species over successive periods until the present form or one closely approximating it was reached.

The bearing of geographical distribution on the problem of

Evolution

evolution lies in the fact that the difference between the species of two regions varies directly with their degree of isolation or proximity. Thus the lizards of the Galapagos Islands resemble those of South America, the nearest mainland, rather than those of the European or African continent, indicating a common ancestry in spite of the adaptive variations that have differentiated them from their neighbors.

According to the Darwinian theory, which is the theory of evolution now generally accepted by evolutionists, evolution as it has already taken place and as it is in progress to-day is determined, immediately at least, by what is known as natural selection. No two individuals are identical, variations occurring as the result of environmental, functional, and congenital or hereditary influences. In the great struggle for existence, due largely to the excessive reproduction of the species, the unfit perish—are eliminated; only the fittest survive, due to the fact that they have characteristics which enable them to persist beyond others. According to Darwin, it is these characters—and these alone—that possess 'a real power in the evolution of species.'

Evolution of Man.—According to the evolutionist, man takes his place in the evolutionary scheme just as truly as do the Protozoa, the Amphibia, the reptiles, birds, and lower mammals; and it is just here that the evolutionist and the believer in special creation find their greatest point of divergence. The evolutionist reasons as follows: A study of the human organism shows it to belong first of all to that division of animal life known as the vertebrates, while certain definite characteristics place it in the subdivision mammalia. It would, however, still be possible that man constituted a separate order which he shared with none of the so-called lower animals, but that he is unmistakably linked by certain peculiarities of structure and habit with that group of animals known as the Primates, of which the distinguishing characteristics are: the placental attachment of the unborn young within the parent; the prehensile limbs; the number and structure of the teeth; the number of digits; the superior development of the clavicles; the structure of the eye socket; and the possession of two mammary glands at which the young are suckled. Against these common characteristics, are set the distinctive features of the human race—man's erect carriage and his greater brain development, with the resulting powers of speech and reason; and even these, say the evolutionist, are differences of degree alone. Passing from the Marmosets, the lowest order of the Anthropoidea (one of the two great divisions of the order of Primates) to the tailed monkeys, thence to the baboons, and to the true apes (Simiidæ), to which belong the gibbon, orang-outang, chimpanzee, and gorilla, one finds a progressive development of the brain and an increasing tendency to assume an upright posture—in short, an increasing resemblance to the human species, which forms the culmination of this order. Add to this the presence in the human organism, particularly in the stages of infancy and fetal development, of certain rudimentary structures—as the vermiform appendix—appearing in a higher degree of development in the lower Primates; the development of the human embryo from a single cell, through various stages recapitulating the history of the race; and the evidence of fossil remains and the geographical distribution of the races of mankind; and the evolutionist holds that this theory of physical evolution, at least, is complete.

The evolution of man's mind is based on the invariable relationship between the mind, as we ordinarily conceive it, and the human brain. It is traced by studies similar to those by which physical evolution is established—comparative psychology furnishing evidence comparable to that of comparative anatomy in the physical realm, supplemented by the study of the development of the brain and of the mental processes in fetal and pre-adult life, and by the records of historic and prehistoric races.

The simple response to external stimuli that is observed in the single-celled Amœba has in the Hydra, or jellyfish, become the function of a special group of cells set apart, as it were, for the reception of stimuli and for the conduction of impulses. In the earthworm the nervous system is still more highly developed and what were looked upon as mere reflexes in the lower animal forms comes to be known as instinct. The communal insects—ants and bees—show a still further development, and this continues through various animal forms, till in the cat, the dog, the horse, and other of the higher animals, we have that ability to profit by experience and modify response to external stimuli that is termed intelligence. In the mental realm, as in the physical, the apes, with their greater susceptibility to training and their more elaborate nervous mechanism, form a transitional stage between the inferior mammals and man with his highly developed nervous system and greater mental capacity. The chain of evidence produced by a study of the animal forms in sequence is borne out, according to the evolutionist, by anthropological study of the development of the manlike precursors to modern man.

The mental development of man from childhood to maturity is cited as still further evidence of the evolutionary process in the mental realm. The reflex and mechanical activities of the newborn infant, corresponding to those of the lower animals, give way gradually to a higher order of intelligence in the child of seven or eight months, that is in turn superseded, or supplemented, by the development of reasoning powers, simple at first, but gradually reaching their fullness with the advance from adolescence to manhood.

Much has been said of the records of prehistoric and early historic races and their bearing upon the problem in hand. To go into this matter in detail is beyond the scope of the present article. The basic idea however is contained in the following quotation: 'Written history furnishes a wealth of material for interpreting the mental conditions of ancient peoples, but beside documentary evidence, the anthropologist learns to use inscriptions of prehistoric times, the primitive graphic representations on tombs and monuments, and even the characteristics of crude implements like axes and arrow heads . . . a little thought will show that a man who used a rough stone axe in the time of the ancient Celts could not possibly have had a mind which included the conception of a finished tool or modern mechanism. So in all departments of human culture, the evolution of material objects may be justly employed in interpreting and estimating the mental abilities of ancient peoples' (Crampton).

The application of the doctrines of evolution to human relations constitutes a special phase of the subject, generally discussed under the heading of *social evolution*. Social organization, according to the social evolutionist, has its prototype in the cell organization that characterizes even the lower stages of animal life; it is evidenced in the communal life of certain insects—wasps, bees, ants—and it is traceable in human affairs by the gradual stages that mark the advance from savagery, through barbarism, to civilization.

History.—The theory of evolution is not a product of the nineteenth century—an idea which had its origin with Darwin. It was foreshadowed by

Courtesy Buffalo Museum of Science

EVOLUTION OF LIFE

GEOLOGICAL AGES FOLLOWING THE PRECAMBRIAN, WHICH LASTED 550,000,000 YEARS, SHOWING DIAGRAMMATICALLY THE FOSSIL RECORD OF EVOLUTION.—(2) CAMBRIAN, 60,000,000 YEARS; (3) ORDOVICIAN, 75,000,000 YEARS; (4) SILURIAN, 30,000,000 YEARS; (5) DEVONIAN, 45,000,000 YEARS; (6) CARBONIFEROUS, 60,000,000 YEARS; (7) PERMIAN, 30,000,000 YEARS; (8) TRIASSIC, 22,500,000 YEARS; (9) JURASSIC, 37,000,000 YEARS; (10) CRETACEOUS, 50,000,000 YEARS; (11) EOCENE-PLEISTOCENE, 39,000,000 YEARS; (12) PLEISTOCENE, 10,000,000 YEARS; (13) RECENT, 20,000 YEARS

Lucretius, Empedocles, Aristotle, and other early philosophers, and appears, although somewhat vaguely, in the middle ages. Descartes' mechanistic view of the universe, and the theory that the genera of all beings follow one upon another in a continuous progression, as held by Liebnitz, and by Herder and other German philosophers, are early modern manifestations of the theory that was later crystallized by Darwin and that is so closely associated with his name. The three names that stand out pre-eminent in the development of the evolutionary theory prior to Charles Darwin are those of Buffon, Lamarck, and Erasmus Darwin. Buffon (q. v.) explained the variations among animal and vegetable forms as the effect of environmental influences. He held further that these effects were immediately hereditable, and recognized also, with some degree of clearness, the consequences of the struggle for existence in the history of the race. Erasmus Darwin (q. v.), grandfather of Charles Darwin, on the other hand, explained the variation of species as largely the result of functional influences—that is, the use or disuse of certain members—although like Buffon he accepted the view that acquired characteristics were transmittable by heredity. His theory was adopted and elaborated by Lamarck (q. v.) whose *Philosophie Zoologique* was characterized by Haeckel as 'the first connected exposition of the theory of descent carried out strictly into all its consequences.'

It remained, however, for Charles Darwin to formulate a theory that proved acceptable to a large body of scientists, though Alfred Russel Wallace (q. v.), working independently, arrived at similar conclusions at practically the same time. For a fuller discussion of their theory, based on natural selection, see DARWINISM.

The Darwinian theory has been the theme of a wide range of literature, and its protagonists and opponents have been numerous. Among those who have upheld it and contributed to it the results of further investigation are Hooker, Huxley, Müller, Haeckel, Herbert Spencer, who treated the subject from the philosophic point of view, Weissmann, Mendel, and De Vries. For the contributions of these investigators the reader is referred to the articles, elsewhere in this work, dealing with their lives.

The opponents of the theory of evolution attack it as merely an hypothesis, unsupported by facts. 'If the hypothesis were true,' says one writer, '(that is, if all the species known to-day came by gradual change from one or a few germs of life, as Darwin thought they did), every square foot of the earth's surface would teem with conclusive proof of this law of change. But, as a matter of fact, with something like one million species (estimated) and with millions of specimens examined, they have failed to find one single species that can be shown to have come from another. They find nothing in process of change—everything is perfect. Wherever there is found living to-day any species of which an ancestor has been found in the rocks the living descendant is like the fossil ancestor. If this is what the evidence proves, why should we assume the truth of an hypothesis which is contradicted by everything that has been found and supported by nothing?'

It is declared also that the theory of evolution fails to account for the origin of life, and that its explanations of natural phenomena are 'fantastic and unbelievable.' Furthermore, it is at variance with the Biblical record of creation, which declares that God made man in His own image, and constitutes, therefore, a direct attack upon the Bible as an inspired book. It tends to weaken man's belief in a personal God, upon which rest all the great controlling influences of life. If carried to its logical conclusion, it destroys the whole structure of the Christian faith, and leaves man 'adrift upon a tempestuous sea without chart or compass to guide him.' The doctrine of the 'survival of the fittest' is cited as the real basis for the vicious teaching that 'might makes right,' as a breeder of class consciousness and of industrial conflict. In short, its enemies declare, the theory of evolution, without a basis of fact, substitutes a man-made theory for the revelation of God, replaces the spiritual by the material, and leads to agnosticism and eventually to atheism.

Bibliography.—In connection with the subject of Evolution the reader is referred to the articles in this work dealing with BIOLOGY, HEREDITY, EMBRYOLOGY, and PALÆONTOLOGY.

The literature of the subject is extensive, and only a few of many treatises may be mentioned here. Special reference is made to Crampton's *The Doctrine of Evolution: Its Basis and Scope* (1911) as a clear concise treatment of the subject for readers not scientifically trained. Consult also Darwin's *The Origin of Species;* Eimer's *Organic Evolution;* Weissmann's *Studies on the Theory of Descent* and *The Evolution Theory;* Clodd's *Story of Creation, Pioneers of Evolution,* and *Primer of Evolution;* De Vries' *Species and Varieties;* Butler's *Evolution Old and New;* Kellogg's *Darwinism To-day;* Osborn's *Origin and Evolution of Life;* Tyler's *Man in the Light of Evolution;* Newman, *Evolution, Genetics, and Eugenics;* Morgan, *The Scientific Basis of Evolution;* Osborn, *From the Greeks to Darwin;* Mason, *Creation by Evolution.*

Evolution, in mathematics. See INVOLUTION.

Evora, ev'ō-*ra*, town and archiepiscopal see, Portugal, capital of the province of Alemtejo; 72 miles east of Lisbon. The town is beautifully situated in a fertile plain surrounded by mountains, and its Moorish and mediæval character makes it one of the most interesting towns in Portugal. Noteworthy buildings are the Cathedral, built in the twelfth and restored at the close of the thirteenth century; the Public Library; a Roman Temple of the first or second century A.D.; the former Jesuit university, now a police-office, grammar school and orphanage; and an ancient Roman aqueduct still in use. There are manufactures of cotton and woollen goods and wine. The town is the headquarters of a division of the army.

From 80 to 72 B.C., Evora was the chief stronghold of Sertorius. It was captured by the Moors in 715 and recovered from them in 1166. Pop. (1930) 22,061.

Evrémond, ā'vr'-môń', CHARLES MARGUETEL DE SAINT-DENIS, SEIGNEUR DE SAINT (1613–1703), French essayist and poet, was born in St. Denis, near Coutances, in Normandy. He was educated chiefly in Paris and began the study of law but, preferring a military career, entered the army, accompanied Bassompierre to Italy, and during the Thirty Years' War won renown at Rocroi, Freiburg, and Nördlingen. At court he was esteemed the brightest and most versatile of the many wits of the day. Having offended Louis XIV. by certain writings, he became an exile, and fled to Holland whence he proceeded to England (1663), where he resided for forty years. He died in London, and was buried in Westminster Abbey. As a critic and letter-writer, Saint Evremond's style reaches a high state of perfection, with its sententious brevity, incisive wit, and polished antithesis. His collected works were published in 1705 (Eng. trans. 1728). Consult *Life,* in French, by Macé (1894).

Evreux, ā'vrû (Lat. *Eburovices*), town and archiepiscopal see, France, capital of department Eure, is situated on the Iton river; 65 miles northwest of

Courtesy American Museum of Natural History, New York

EVOLUTION OF THE HIND FEET OF PRIMATES

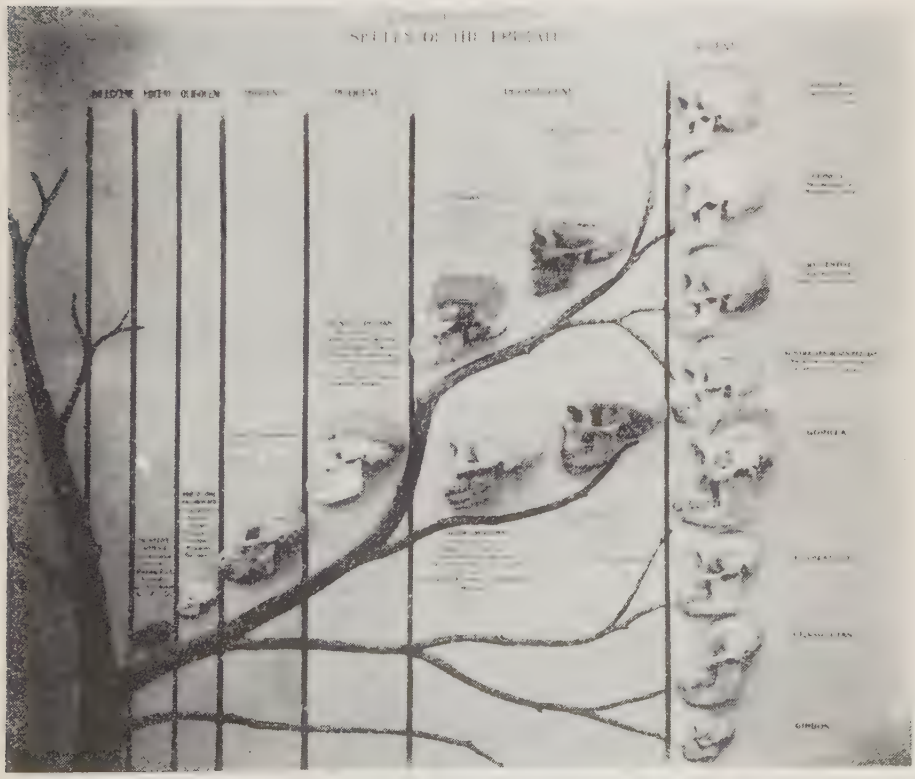


Photo courtesy Buffalo Museum of Science

EVOLUTION OF THE SKULLS OF THE PRIMATES

Paris. Its most interesting buildings are the Cathedral (11th century), restored in 1896, with Cloisters and the Bishop's Palace adjoining; the Tour de l'Horloge, or clock tower (1490); the church of St. Taurin; and the Palais de Justice. Paper, textiles, iron and copper ware, and leather goods are manufactured, and there is a large trade in grain. A Roman settlement four miles southeast of the present town was destroyed by the Franks under Clovis, and the succeeding town was overthrown by the Norsemen at the close of the 9th century. Evreux was twice destroyed by fire, by Henry I. of England, and by Philip Augustus of France. Pop. 18,957.

Ewald, ā'vält, GEORG HEINRICH AUGUST VON (1803–75), German orientalist and theologian, was born in Göttingen. He was educated at the University of Göttingen and in 1827 was appointed professor of philology there, but was dismissed (1837) for protesting against the annulment of the Hanover Constitution. He was then elected (1838) professor at Tübingen University, resuming his old position at Göttingen in 1848 (until 1867). He was an opponent of the Tübingen school, was a profound scholar, and had much of the fiery spirit of the ancient prophet of Israel. His greatest work, and the ambition of his life, *The History of the People of Israel* (Eng. trans. 1867–86), was completed in 1859. Other works, which are numerous, include *A Grammar of the Hebrew Language* (Eng. trans. 1836); *Syntax of the Hebrew Language* (1879); *Die Poetischen Bücher des alten Bundes* (1835–9); *Die Propheten des alten Bundes* (Eng. trans. 1875–81); *Die drei ersten Evangelien und die Apostelgeschichte* (1871–2); *Die Lehre der Bibel von Gott* (1871–6; Eng. trans. 1884). Consult T. W. Davies' *Heinrich Ewald.*

Ewald, JOHANNES (1743–81), Danish poet, was born in Copenhagen. As a boy he enlisted in the Prussian service, which he later deserted to enter the Austrian army. After his return to Copenhagen (1760), he applied himself to theological study but the success of a poem composed by him on the death of Frederick V. led him to devote himself to a literary career. In 1773 he settled at Rungsted, where he wrote his famous ode *Rungsteds Lyksaligheder* and the heroic opera *Balders Död* (Eng. trans. *The Death of Balder*, 1889). To a later period belong his fine lyrics *Til Sjaelen* and *Til min Moikte.* In 1778, at the request of the queen-dowager, his *Balder* was acted at the Royal Theatre, and in the same year he wrote his most beautiful work, the opera *Fiskerne* and the fine autobiographical *J. Ewalds Levnet og Meninger.* Consult *Life,* in Danish, by A. D. Jörgensen.

Ewbank, ū'bangk, THOMAS (1792–1870), American scientist and writer, was born in Barnard Castle, Durham, England. He emigrated to New York in 1819, and from 1820 to 1836 was engaged in the manufacture of tin and lead tubing. From 1849 to 1852 he was United States Commissioner of Patents. His works include a book on hydraulics (1842; numerous editions); *The World a Workshop* (1855); *Life in Brazil* (1857); *Thoughts on Matter and Force* (1858); *Reminiscences in the Patent Office* (1859); *Inorganic Forces Ordained to Supersede Human Slavery* (1860).

Ewe, ā'wā, a linguistic group of negro people of the Slave Coast, West Africa, whose domain lies between Yorubaland and the river Volta, comprising the former German and present French colonies of Togoland and Dahomey. They present the usual characteristics of the uncivilized negro. When young they evince an almost precocious intelligence but upon maturity the intellect appears almost completely deadened, and they become idle and sensuous. The Ewe language comprises a number of dialects, including Mahi, Dahomi, Anfueh, Awuña and Whydah, of which Mahi is the purest. Consult Kingsley's *West African Studies* and Ellis' *The Ewe-speaking Peoples.*

Ewell, ū'el, RICHARD STODDERT (1817–72), American Confederate soldier, was born in Georgetown, D. C. He was graduated from West Point in 1840, served as a first lieutenant (commissioned 1845) in the southern campaign of the Mexican War (1847–8), receiving (1849) the brevet of captain of dragoons for services at Contreras and Churubusco, and took part in the contest with the Apaches in New Mexico (1857–9). On the outbreak of the Civil War he joined the Confederate army, in which he served with great distinction. He commanded a brigade in the first battle of Bull Run (July 21, 1861), and a division in 'Stonewall' Jackson's campaign in the Shenandoah Valley (1862) against Frémont and Banks (defeating Frémont at Cross Keys), and subsequently served under Jackson in the Peninsular campaign, in the second battle of Bull Run, and at Groveton, where he lost a leg. After the battle of Chancellorsville he was promoted to the rank of lieutenant-general. He was placed in command of one of the three corps of the Army of Northern Virginia, led the advance into Pennsylvania under Robert E. Lee, and at Gettysburg (q. v.) commanded the Confederate left, part of his troops beginning the battle on the first day. He subsequently served with great ability in the final campaign against General Grant, and on April 6, 1865, with about 8,000 men, was forced to surrender to Sheridan at Sailor's Creek, Va.

Ewing, ū'ing, FINIS (1773–1841), American clergyman, was born in Bedford county, Va., and, moving westward, finally settled in Logan county, Ky., where in 1802 the local presbytery licensed him to preach. He did active work as a revivalist, but was not recognized by the Kentucky synod, and in 1810, with two other clergymen, founded the Cumberland Presbyterian Church, which grew to large proportions. He was pastor of churches in Kentucky and Missouri until his death. He published *Lectures on Important Subjects in Divinity* (1824). Consult Cossit's *Life.*

Ewing, HUGH BOYLE (1826–1905), American lawyer and soldier, was born in Lancaster, Ohio. He studied at West Point, went to California (1849), and returning to Ohio (1852), studied law. He practised in St. Louis, Mo., and at Leavenworth, Kan., and in 1861 was appointed brigade inspector with the rank of major in the Ohio Volunteers. The following year he was appointed brigadier-general; and in 1865 received the brevet of major-general. He fought at Antietam, Vicksburg, and Chickamauga. In 1866 he was appointed U. S. minister to Holland, where he remained for four years. He published *The Grand Ladron, a Tale of Early California; A Castle in the Air* (1887); *The Black List* (1893).

Ewing, JAMES (1866–), American pathologist, was born in Pittsburgh, Pennsylvania. He was graduated from Amherst College in 1888, and studied medicine at the College of Physicians and Surgeons of Columbia University and at the University of Pittsburgh. He became a tutor of histology (1893–7), Clark fellow (1896–9), and instructor of clinical pathology (1897–8) in the College of Physicians and Surgeons, and after 1899 served as professor of pathology at the Cornell University Medical School. In 1907 he was named director of the Association for Cancer Research. His works include *Clinical Pathology of the Blood* (1900–3); articles on *Identity, The Signs of Death, and Sudden Death* (in *Text-Book of Legal Medicine and Toxicology*, 1903); articles on the *Blood* (*Text-Book of Legal Medicine*, 1910); *Neoplastic Diseases* (1919).

Ewing, SIR JAMES ALFRED (1855–), Scottish civil en-

gineer and physicist, was born in Dundee and educated at the University of Edinburgh. He was engaged in engineering work until 1878, when he was appointed professor of mechanical engineering, Tokyo University, Japan. He remained there until 1883, was professor of engineering at University College, Dundee, from 1883 to 1890; professor of applied mechanics at the University of Cambridge from 1890 to 1903; and director of naval education from 1903 to 1916. In 1916 he became Principal and Vice Chancellor of the University of Edinburgh. He published *Treatise on Earthquake Measurement*, published by the University of Tokyo (1883); *Magnetic Induction in Iron and other Metals* (1891); *The Steam Engine and other Heat Engines* (1894); *The Strength of Materials* (1899); *The Mechanical Production of Cold* (1908); *Thermodynamics for Engineers* (1920).

Ewing, James Caruthers Rhea (1854–1925), American educator, born in Rural Valley, Pennsylvania. He was graduated from Washington and Jefferson College in 1876, and studied at the Western Theological Seminary. He was ordained to the Presbyterian ministry in 1879, and went as a missionary to India, where he became professor in a Theological Seminary (1884–8); president of Forman Christian College in Lahore (1888–1918); and dean of the faculty of arts (1890–1907) and vice-chancellor (1910–17) of the University of Punjab. For his educational work in India, he received from Edward VII. of England the Kaiser-i-Hind Gold Medal (1907) and from George V. the citation 'Companion of the Indian Empire' (1915). He wrote numerous articles and books in the Indian vernaculars.

Ewing, Juliana Horatia (1841–85), English writer for children, was born in Ecclesfield, Yorkshire, a daughter of Margaret Gatty, author of *Parables from Nature*. Most of her stories, before separate publication, appeared in *Aunt Judy's Magazine* (1866), edited by her mother and, after the latter's death, by Juliana and her sister. After her marriage to Major Ewing (1867), she cultivated a deep interest in soldiers, shown strikingly in many of her tales. Of these the best known are *Jackanapes* (1884), *Jan of the Windmill* (1876), *Six to Sixteen* (1876), *A Great Emergency* (1877), *The Story of a Short Life* (1885), *The Land of Lost Toys* (1869), and *A Flat Iron for a Farthing* (1873).

Ewing, Thomas (1789–1871), American lawyer, and statesman was born near West Liberty, Va. His family removed to Athens county, Ohio, in 1792, and he was graduated from Ohio University (1815), and was admitted to the bar at Lancaster, Ohio, where he practised with marked success for fifteen years. He was a Whig member of the U. S. Senate (1831–7), and as such vigorously opposed President Jackson's policy with regard to the second United States Bank. He was secretary of the treasury (March-September, 1841) in the cabinets of Presidents Harrison and Tyler; was the first secretary of the interior (1849–50), in the cabinet of President Taylor; and was again (1850–1) a member of the Senate, in which he was a conspicuous opponent of the compromise measures of 1850. Subsequently resuming his law practice, he won a place as one of the leaders of the Ohio and the national bar. He was a delegate to the Peace Congress of 1861, but supported the war policy of President Lincoln in 1861–5, and was subsequently opposed to the reconstruction policy of the Radical Republicans.

Examination, in education, a form of test designed to show the student's familiarity with subjects already pursued or to demonstrate his fitness for more advanced work. In the days of the mediæval universities, admission to the degree in arts was conditioned by the candidate's skill in defending a thesis in a public disputation. After the Reformation such debates gradually gave way to the modern system of examination by questioning. At the present time college and university examinations are usually conducted in writing. For the higher degrees, a thesis on some phase of a study is also required, and until recently the thesis in German universities was defended before representatives of the faculty.

Admission to college usually depends on a formal examination on specified subjects. Of late years there has been a tendency to unify these requirements, and in 1900 a College Entrance Examination Board was organized, whose examination is accepted by an increasing number of colleges in lieu of a special examination set by the college. The effect of this system is to produce definiteness and economy of time and effort in preparatory schools. In 1911 Harvard University adopted a plan, later accepted by Yale, Princeton, Smith, Vassar, Wellesley, Mount Holyoke, and others, whereby a student may satisfy the entrance requirements by passing examinations in each of a few subjects, known as 'comprehensive examinations'; and beginning in June, 1916, a series of this type was adopted by the College Entrance Examination Board. The passing of these comprehensive examinations may be accepted for admission as an alternative to the passing of the usual Board examinations. The awarding of prizes, fellowships, and other university honors is sometimes based upon competitive examination.

In the public-school system so much emphasis has been laid on formal examinations that, in the opinion of many well known educators, the value of the instruction has been seriously menaced. Examinations may be internal, conducted mainly by the teachers of the pupils examined, in which case education may be said to dominate the examination, or they may be external, the examination being conducted by a body outside and independent of the school or college, in which case the examination dominates the education. In Germany and the United States the tendency is to limit the number of examinations as much as possible and to build up a strong teaching profession whose decisions on the proficiency of the pupil may be accepted without question. In France each step in educational progress is marked by State control. England has done away with examinations in elementary schools to a large extent but in secondary education there is an extensive examination system.

For competitive examinations, see also Civil Service.

Exanthemata, ek-san-them'*a-ta*, a term applied in medicine to those fevers which are accompanied by skin eruptions, such as scarlet fever, measles, and smallpox. Sometimes, but not so generally, it is applied also to rashes unaccompanied by fever.

Exarch, eks'ärk, in the Roman empire, the title borne by the viceroy of the Byzantine emperor in Italy, from the 6th century to the 8th (751), when Ravenna, the capital of the exarchate, fell into the hands of Aistulf, king of the Longobards. Ecclesiastically, exarch was a title intermediate between patriarch and metropolitan; but it has had various other uses—*e.g.* in the modern Greek Church, the deputy or legate of a patriarch. The spiritual head of the modern Bulgarian Church bears the title of exarch.

Excavation and Excavators. Excavation is the process of removing rock or earth for the purpose of making a railway cutting, a canal, or a dock, of driving a tunnel or sewer, or of clearing a space for the foundations of a bridge, wall, or building. In cases where deep trenches for retaining walls have to be excavated, the soil is often lifted out in large buckets by cranes standing up above. If rock is met with, the part to be removed is first shattered by charges of explosives

placed in holes drilled for the purpose. The sides of excavations for foundations have, unless of rock or other unyielding formation, to be supported by a system of timbering.

In extensive excavations some form of mechanical excavator is usually employed. There are two general types. The first, which is known as a steam or an electric shovel, works at the bottom of the cutting, and consists essentially of a portable crane and a heavy bucket or scoop. The jib of the crane rotates on a fixed frame and on a short movable arm, and carries the bucket, which is controlled by chains. The bucket is provided with steel teeth on its lower front edge, to bite into the earth, and a hinged bottom, counterbalanced by a heavy handle, and closed with a catch. The shovel being brought into position, the bucket is lowered to the base of the working-face, and is pulled up it by the chain, scooping off a load of earth in its progress. The crane then swings round and the bucket discharges its contents through the opened bottom into a car standing ready.

The second type of excavator resembles a dredge, having a series of buckets running on an endless chain. The machine stands (on rails) at the top of the cutting, and the jib holding up the chain is adjusted over the site to be excavated so that the buckets cut the earth, which they scrape away and deposit in wagons or cars behind the machine. This machine is capable of moving more earth in a given time than the former, but is only suitable for shallow cuttings. A similar device is extensively employed in sewer construction as the excavator can be mounted on rails over the trench to be excavated.

See DREDGING; STEAM SHOVEL. Consult McDaniel's *Excavating Machinery* (1913).

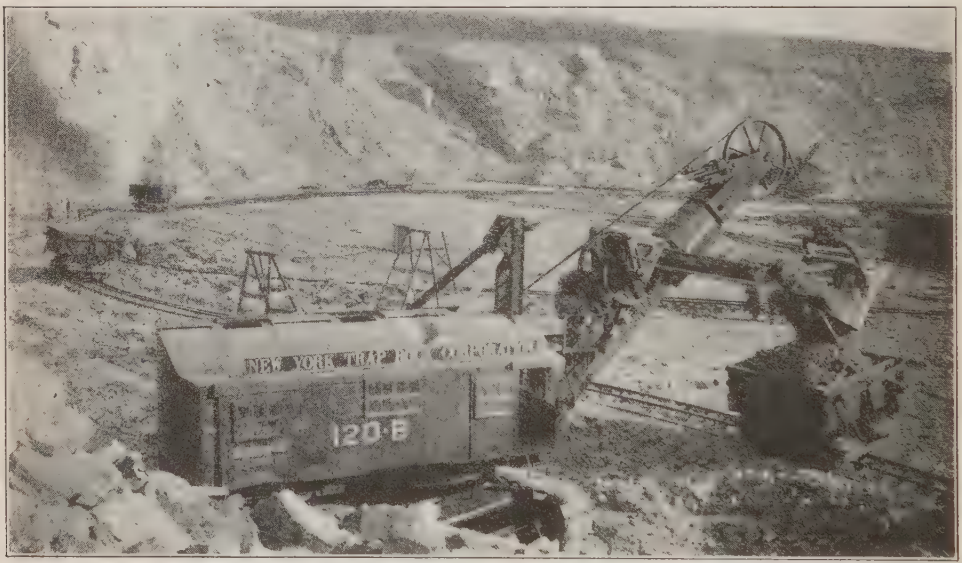
Ex'cellency, a title of honor, given in the United States to governors of States, and to U. S. ambassadors and ministers to foreign countries. The title is borne in Great Britain by the ministers of foreign powers, and outside Britain by ambassadors, plenipotentiaries, viceroys, and governors of colonies.

Excel'sior, a packing material consisting of wood shavings of varying degrees of fineness, made usually from poplar and bass wood. The material is also used for stuffing cushions, beds, etc. It was first manufactured in the United States about 1860.

Excelsior Springs, city, Missouri, Clay county, on the Chicago, Milwaukee, and St. Paul, and the Wabash Railroads; 25 miles northeast of Kansas City. It has mineral springs and is a summer and health resort. Pop. (1910) 3,900; (1920) 4,165.

Excess-profits Tax, a tax levied on business profits when such profits exceed a moderate percentage of the capital invested. During the Civil War the State of Georgia levied a tax of 5 to 25 per cent on business profits over 8 per cent of the capital stock. In Great Britain a tax of 40 to 80 per cent was levied in 1915 on profits above the average of profits for any two of three years before the outbreak of the War. In the United States a tax of 8 per cent was levied in March of 1917 on profits above 8 per cent of the capital invested. In October of 1917 this measure was altered to provide a tax on business incomes in excess of an amount equal to a maximum of 9 per cent return on the average total of capital employed in business during the years 1911–13. Then came a dual tax, applied in 1918: 80 per cent war tax or 30 to 65 per cent excess-profits tax, whichever was greatest. Because of its inequalities and complexities this tax was discontinued in 1921. In 1933 a new excess-profits measure imposed a 5-per-cent tax on net income of corporations above 12½ per cent of the adjusted declared value of capital stock. This rate was raised in 1935 to 6 per cent on net income over 10 per cent and up to 15 per cent on the adjusted declared value of capital stock, the rate being 12 per cent on net income over 15 per cent.

A tax on undistributed profits, similar in effect to excess-profits taxes, was introduced in the Revenue Act of 1936, providing that corporations (banks excepted) must pay surtaxes on all net income not distributed to stockholders; this on a graduated scale from 7 to 27 per cent depending on the proportion of profits retained. The sponsors of this measure argued that it would serve to transfer profits into the hands of stockholders, thereby subjecting these profits to personal-income taxation with resulting



Courtesy of the Bucyrus Co.

Electric Shovel for Mines and Quarries

Exchange

gains in government revenues. In 1938, however, a revision of the undistributed-profits measure greatly diminished the validity of many of its provisions.

Exchange, an ancient mode of conveying real property (abolished in England and obsolete in the United States), by the mutual grant of equal interests in different holdings, one for the other. Transactions of this nature in modern times have ordinarily been effected for the sake of convenience through deeds in lieu of mutual grants of interest.

Exchange, a name applied (1) to the place where merchants meet at certain hours for the transaction of business, and (2) to the assemblage itself. See SPECULATION; STOCK EXCHANGE.

Exchange, in political economy, means the giving of what we have, but do not particularly require, for that which we want, but have not.

Exchange has existed from the earliest times. As soon as the primitive division of labor into agriculturist, weaver, smith, and carpenter was established, there must have followed a mutual exchange of the produce of these callings. But the early exchange was practicable only under very restricted local conditions, for the means of transport and communication were not sufficiently developed to convey the staple commodities of industry over great distances. Indeed, until the means of transport and communication were revolutionized by steam and electricity, all articles of considerable weight and bulk in proportion to their value were in general consumed at the place where they were produced. With these advances, exchange has become a dominating principle in economics.

The growth of a world-wide exchange has naturally led to a corresponding development of the instruments of exchange. Money has been described as the mechanism of exchange, for though in its origin it was itself simply a commodity, in modern times its importance as a medium of exchange has been foremost. Metallic money, however, no longer serves as the sole mechanism; and other more refined devices have been introduced to facilitate exchange. These may be summed up in the term 'credit institutions,' of which banks are the most important example.

See BANKING; ECONOMICS; EXCHANGE, FOREIGN; SUPPLY AND DEMAND.

Exchange, Foreign, the mechanism by which payments between different countries are effected; in ordinary commercial discussion the rate at which the currency of one country is valued in that of another.

In international trade only a small fraction of the value of the goods exchanged is ever transferred in actual money. Obligations are met by offsetting debits with credits, and money is used only for the occasional settlement of balances. A simple illustration will indicate the essential features of international exchange. A shipment of goods is made by A, living in the United States, to B, in England. A draws a bill on B (in pounds sterling) and sells it to D, who has purchased goods from C in England. D makes payment by remitting the bill to C. C deposits the bill in his own bank, and it is then cleared through the regular banking channels until it reaches the home bank of B and is charged against his account. The exchange is not actually carried on by the individual immediately concerned but is handled by bankers and brokers who act as intermediaries and buy and sell the bills of merchants and traders.

The rate or price of exchange is determined by the same factors which determine the rate of exchange of any other market commodity. In other words, it is an expression of the interaction of demand and supply. Three factors are generally involved: (1) the amounts of pure gold in the monetary units to be exchanged, (2) the cost of shipping gold, and (3) the trade and credit relations of the two countries.

If two countries are to carry on trade relations, it is necessary that they translate the language of values of one into the language of values of the other. If the same standard is used in both, a common language is arrived at by calculating the par of exchange, that is, the exact equivalent of the unit of one nation in terms of the other. Thus, in the United States the dollar represents 23.22 grains of pure gold. The par of exchange with any gold standard country, therefore, is determined by dividing the weight of grains of pure gold in the unit of value by 23.22. Thus $4.86 2/3 is the par between the United States and England, since one sovereign contains the same amount of pure gold as $4.86 2/3. When the value of American money equals that of English money the two are said to exchange at par. If the value of money of the United States measured in English money rises, as when one sovereign exchanges for $4.85, English exchange is said to be at a discount; if the value of the dollar falls, and one sovereign becomes equal, for example, to $4.88, sterling is at a premium. Between two countries having different standards of value, as one having a gold standard and one having a silver standard, the relative market values of the two metals serve as the basis of commercial transactions rather than the par of exchange.

Various factors limit the range of the fluctuations of exchange, the most important of which is the cost of shipping gold. Suppose, for example, that it costs 2 cents to ship $4.86 2/3 worth of gold bullion from New York to London. If sterling exchange rose above $4.88 2/3 or fell below $4.84 2/3, it would be cheaper to ship gold bullion than to pay the premium, or suffer the discount, on commercial paper. These points, spoken of as the 'gold export points,' 'gold import points,' or 'specie points,' represent the extreme limits to the fluctuation of exchange rates under normal conditions, but are in themselves variable, since the cost of shipment is influenced by such factors as the size of shipment, the freight, insurance and interest rates, and other factors.

Trade and credit relations between two countries constitute the third factor determining the actual rate of exchange. The movement of merchandise, the placing and payment of loans, the sale and purchase of securities, and the payment of interest and dividends on foreign-held securities are some of the factors which necessitate the transfer of funds from one country to another. When a country's debits contracted in any of the ways mentioned exceed its credits, exchange is said to be 'unfavorable,' reflecting the mercantilist belief that the drain of money required to adjust such a situation is injurious to the country. If, on the other hand, credits exceed debits, foreign exchange falls to a discount and a 'favorable' exchange is established.

Bills of exchange are drawn for varying periods of time, and the length of the term for which a bill is drawn affects the rate at which it will be accepted. In the case of long-time bills, the condition of credit and rates of interest in both countries affect its value, for the buyer must consider the loss of interest until the bill matures and must be compensated for the risk involved.

When the exchanges are 'unfavorable,' it is sometimes considered advisable to 'correct' them. This is done by various methods. In England, it is common practice to raise the discount rate of the Bank of England. The effect of this is to check the export and encourage the import of gold. Other coun-

tries have imposed indirect restrictions on the export of bullion. Still another temporary device is the negotiation of a loan placed abroad, which is equivalent for the time to an export of goods.

During the abnormal conditions of the World War, rates of foreign exchange suffered wide fluctuations, due largely to the distortion of the balance of trade in favor of the neutral nations, and to the issue of great volumes of irredeemable paper currency issued by many of the belligerents.

Consult J. S. Mill's *Principles of Political Economy;* R. T. Ely's *Outlines of Economics;* R. T. Ely and G. R. Wicker's *Elementary Principles of Banking;* W. A. Scott's *Money and Banking* (1926 ed.). G. C. Clare's *A B C of the Foreign Exchanges* goes more fully into details, while Seyd's *Bullion and Foreign Exchanges* and Margraff's *International Exchange* supply a large amount of technical information.

Exchequer, eks'chek-*er*, that department of government concerned with the public funds. The *Court of Exchequer* in England was originally founded as a branch of the national exchequer to supervise cases affecting the king's revenue, but it ultimately acquired a general jurisdiction both in equity and common law. In equity this jurisdiction was abolished in 1841; and at common law the Court of Exchequer became merged in the King's Bench Division in 1880. The *Court of Exchequer Chamber* was a court of appeal which was merged in the Court of Appeal in 1873. Now the management of the national exchequer is supervised by the *Chancellor of the Exchequer*, and entirely separated from the administration of law (see EXCHEQUER, CHANCELLOR OF).

Exchequer Bills, documents of credit formerly issued under Parliamentary authority by the British government in return for monies advanced to it. Except for renewals, there has been no issue since 1861; since that date the treasury has used chiefly Treasury Bills and Exchequer Bonds.

Exchequer Bonds are issued by the British government at various times to cover current expenses which cannot be met from the ordinary sources of taxation. They are issued at a discount, and carry a fixed interest for the whole period of their currency.

Exchequer, Chancellor of the, one of the principal members of the British government and the first finance minister of the crown, with a seat in the Cabinet. He has the complete control and management of all matters relating to the receipt and expenditure of the public money; he frames the annual estimates of the amount necessary to defray the expenditure connected with the public service; and he has also to provide an annual statement of the estimated expenses of government, showing how these charges have to be met by the continuation, remission, or imposition of taxes. The chancellorship can be held by the Prime Minister if he is a member of the House of Commons, the noteworthy cases being those of William Pitt (1804–6), George Canning (1827), Sir Robert Peel (1834–5), and W. E. Gladstone (1873–4 and 1880–2), all of these statesmen holding the combined offices.

Excise Taxes, ek-sīz', consist generally of taxes laid upon the manufacture, sale, or consumption of commodities within a country, upon transactions, and upon certain callings or occupations, the latter often taking the form of licenses to pursue these callings. Excise taxation in its modern form was first developed in Holland, where in the seventeenth century it was the chief fiscal reliance. It was introduced into England at the time of the struggle between Parliament and Charles I., and was employed extensively under the Protectorate, taxes being levied upon many articles of food and clothing.

United States.—In America the excise system was used in the colony of New Netherlands soon after its establishment. It was extended, after the colony passed under English rule, to the other Middle Atlantic colonies, and in 1737 to Massachusetts. Its first use by the Federal Government under the law of 1791, imposing a tax upon spirits, encountered violent opposition, resulting in the Whiskey Insurrection (q.v.) in Pennsylvania in 1794. The tax was unproductive, yielding only $422,000 in 1793, and costing for collection 16.5 per cent. of the total receipts. The need of revenue, however, led to an extension of the excise, in 1794, to the manufacture of snuff and the refining of sugar. Excises were abolished in 1802, but in 1814 were again levied to meet the imperative need of revenue. In 1817 the system of excise taxation was again abandoned. From that time until the outbreak of the Civil War no further excises were imposed. In 1862 the present system of internal revenue taxation was inaugurated by the creation of the office of internal revenue. Moderate excise duties were imposed upon a wide range of articles, and during the Civil War these duties were increased and extended to almost all important products. The taxes proved very productive, the receipts for the year 1864–5 exceeding $200,000,000.

After the Civil War most of the excise duties were repealed; by 1870 the only important ones retained were taxes on spirits, fermented liquor, and tobacco, while duties on liquors were reduced in the interest of greater productiveness of revenue, experience having shown that excessive imposts resulted in evasion of taxation. In 1883 the duties on tobacco were reduced 50 per cent., and a further reduction of 25 per cent. was made in 1890. In 1898, to meet the need for revenue created by the Spanish-American War, the taxes on tobacco and fermented liquors were doubled, and duties were levied upon a number of other articles. Most of these war taxes were repealed in 1901 and 1902.

A special excise, in the form of a tax of 1 per cent. upon the net incomes of corporations, was imposed as a part of the Payne-Aldrich Tariff Act of 1909 (see CORPORATION TAX); but this became inoperative with the enactment of the income tax law (q.v.) in 1913.

To compensate for the fall in revenues from customs duties caused by the World War, the War Revenue Act of 1914 again increased the tax on beer and wines and imposed license taxes on bankers, brokers, and proprietors of theatres, circuses, etc., Stamp taxes were applied to promissory notes, insurance policies, deeds and conveyances, bills of lading, power of attorney, tickets of passage to foreign ports, and on the sale of cosmetics and toilet articles, and special taxes were levied on telegraph and telephone messages. The Act of 1914 was later extended and became a part of the Revenue Act of 1916. Special taxes on corporations and occupations, on transportation and other facilities of commerce, on admissions and dues, and on many commodities previously untaxed were levied by the successive War Revenue Acts.

The Revenue Act of 1921 eliminated the taxes on transportation, *i.e.*, on railroad and Pullman car tickets, freight way bills, and express and pipe line shipments, and also the taxes on the issuance of insurance policies, on soda fountain products and soft drinks, and on toilet and medicinal products. In the Act of 1924 further reductions were made, including the repeal of taxes on communications, elimination of the taxes on theatre admissions under fifty cents, and a reduction in the number of and rates of

special taxes on commodities. Under the Revenue Act of 1926 special taxes were levied on admissions and club dues, automobile bodies and accessories, motorcycles, spirits, bonds and certificates of stock and indebtedness. During the early years of the Roosevelt administration, increased expenditures made necessary new excise taxes on many different commodities. With the passage of the defense appropriation bills in 1940 came new defense taxes, providing for increases in taxes on many of these items, in addition to a new 10 per cent tax on motion picture admissions and increased levies on liquors, beer, cigarettes, playing cards, club fees and dues, radios, matches, and refrigerators. Of the $5,181,573,952 collected as internal revenue in 1939, about 42 per cent was derived from income taxes, most of the remainder being collected as excise on taxable products. Payroll taxes to meet social legislation benefits represented about 14 per cent; gift, estate, and capital stock tax about 9 per cent.

State excise taxes consist chiefly of franchise and other corporate taxes, a variety of excise taxes on public service industries, business license taxes, motor vehicle and gasoline taxes, sales, severance and regulatory taxes. The development of gasoline taxes began with the adoption of this tax by North Dakota, Oregon, Colorado and New Mexico in 1919. At the end of 1920 only five states had such taxes; by 1937, every state in the Union had passed such a tax, the rates ranging from one to five cents a gallon. There was considerable activity in the field of state cigarette and sales taxes at this time, 24 states enacting a consumers' sales tax, retail occupational tax, or use tax by the end of 1939. Several states, furthermore, instituted taxes on retail gross incomes, wholesale gross incomes, and wholesale and retail licenses. 'Severance' taxes, levied on minerals when mined or sold and on timber when cut, were also in force in several states by 1940. See TAXATION.

Consult *Annual Reports* of the U. S. Commissioner of Internal Revenue; *Bulletins* of the U. S. Treasury Department; J. P. Jensen's *Problems of Public Finance* (1924); *Revenue Acts* of 1938 and 1939.

Excl'tants. See STIMULANTS.

Exclu'sion Bill. See JAMES II.

Exclu'sive Brethren, or DARBYITES. See PLYMOUTH BRETHREN.

Excommunication, eks-kom-ū-ni-kā'shun, an ecclesiastical punishment by which offenders are excluded from participation in the rites of the Church. It can be inflicted only upon living, baptized persons who are in possession of their reason and of moral liberty, and who know both the law and the penalty for its transgression. It does not annul any man's baptism, but merely excludes him from the benefits of baptism while it continues.

Among the Jews the first trace of an ecclesiastical ban is found in the time of Ezra, who declared certain offenders 'separated from the congregation' (Ezra x. 8). Eventually three kinds of excommunication developed among them, of which the first (lasting seven days) and the second (lasting thirty days) were disciplinary; the third, 'unsynagoguing,' was employed only for the most serious offences, and lasted indefinitely. For 2,000 years excommunication continued to be the most effective means of discipline in the power of the synagogue, but to-day it is practically extinct.

Excommunication is referred to in the Gospels (Matt. xviii. 15–17; Luke vi. 22; John ix. 22–34, xii. 42, xvi. 2), and it was employed in the Apostolic Church to combat errors of doctrine and faults of conduct (1 Cor. v. 9–13, xvi. 22; Gal. i. 8). Its use continued in the early Church, and gradually an elaborate system of public penance developed. This in time fell into disuse, and exclusion from the sacraments, known as the 'lesser excommunication,' became the regular means of discipline. The old practices of total exclusion from all the blessings and graces of the Christian Church was known as 'greater excommunication.' Lesser or minor excommunication was the penalty for unlawful intercourse of the faithful with those already excommunicated; it was later restricted to unlawful intercourse with certain persons formally named as *vitandi* (to be shunned), and gradually died out, being officially abolished in the Roman Catholic Church in 1884.

The Roman Catholic Church classifies major excommunication as *a jure* and *ab homine*. The former is provided for in the law of the Church, the latter is imposed by an ecclesiastical prelate. A further distinction is drawn between such sentences as are incurred *ipso facto* (technically known as *latæ sententiæ*), and such as do not take effect till after the formal sentence of an ecclesiastical court (called *ferendæ sententiæ*). *Ferendæ sententiæ* are, from their very nature, public; but *latæ sententiæ* may be either public or occult—that is, as they are generally known, or known only to the offender. Finally, excommunication may be either reserved or non-reserved, according as absolution is reserved to a particular person or may be performed by any confessor. Excommunicated persons are either *vitandi* (to be shunned) or *tolerati* (to be tolerated).

The power of excommunication within a diocese rests with the bishop. It may also be exercised by the prelate nullius for quasi-diocesan territories, by regular prelates for religious orders, and by the Pope for the Church at large.

Originally, the power of excommunication was merely a spiritual sword; but with the alliance of church and state, the excommunicate were handed over to the secular arm of the law, civil disabilities were imposed, and sometimes the punishment was death. Pope Gregory VII. claimed power to depose monarchs who had been subject to excommunication, and to release their subjects from allegiance.

The churches of the Reformation continued the practice of excommunication, and for a time it was accompanied by loss of certain political and civil rights. In England, the last of these were removed by statute in the time of George III., and any penalty was forbidden except such imprisonment, not exceeding six months, as the court pronouncing excommunication should direct. Excommunication may not now be pronounced either in England or in Ireland, except as a spiritual censure for offences which come under ecclesiastical jurisdiction. In Scotland, in the Presbyterian Church, lesser excommunication may be pronounced by the kirk session, the greater excommunication only by the presbytery. But excommunication may involve the excommunicator in a suit for defamation of character.

In the United States, excommunication naturally involves nothing more than separation from the ecclesiastical body which pronounces the bans.

Consult the *Catholic Encyclopædia;* Taunton's *Law of the Church* (1906).

Ex div'idend (abbreviated into *ex div.* or *xd*), a Stock Exchange term, meaning that the price at which any stock or share is quoted is one which does not entitle the purchaser to receive the dividend which is about to be paid in respect of it.

Exe, eks, river, England, rises in Exmoor, and flows southeast through Somersetshire. On entering Devonshire it takes a southerly course to the English Channel at Exmouth. The estuary, one mile broad, is navigable for vessels of 300 tons as far as Topsham, about 6 miles from its mouth. The Exeter Ship Canal, connecting Topsham and Exeter, was

completed in the reign of Elizabeth.

Execution, eks-e-kū'shun, the final writ or process of a court whereby its judgment is enforced. It may be directed against the body of a party to an action, serving as a warrant for his arrest, in which case it is commonly known as 'body execution,' or it may direct the sheriff or other officer to levy upon and seize the property of the party named therein, when it is known as 'execution against property.'

The name, form, and manner of issuance of writs of execution vary in the different States, but they are similar in effect in most jurisdictions. The writ usually directs the sheriff of the county or other executive officer first to seize and sell the personal property of the defendant; if that is not sufficient to satisfy the amount of the judgment, to sell the real property, or collect the rents and apply them to payment of the judgment; or if it is a body execution, to seize the person of the judgment debtor, and keep him in custody until the judgment is paid.

The constitutions of most of the States prohibit imprisonment for debt, but in some States this is construed as being intended to protect debtors willing to pay, but unable to do so, and where the debt was contracted in good faith. Upon this theory statutes in many States authorize body execution in cases involving fraud and wilful wrongs. An example is non-payment of a judgment for damages for breach of promise to marry.

All property, with certain statutory exemptions, which vary in different States, is subject to levy and sale on execution. Statutes usually require a sheriff to advertise and sell at public auction, to the highest bidder, property taken under execution. The sheriff's fees and expenses are also taken out of the amount realized on a sale. If the officer cannot find property belonging to the judgment debtor, it is his duty to 'return' the execution to the court from which it issued, with an endorsement thereon stating why he could not enforce it. See JUDGMENT; DECREE; DEBT. Consult Freeman's *Treatise on the Law of Executions.*

Execution, in criminal practice, may be used generally to denote the carrying out of any sentence, but is specially applied to the carrying out of the death penalty. The methods employed to put criminals to death have been as varied as human ingenuity could devise. Until comparatively recent times these were often marked by extreme cruelty even in civilized countries. As late as 1726 a woman was burned alive in England for murdering her husband. Beheading is still practised in Oriental countries and in Prussia, although other parts of Germany and France have adopted the guillotine.

In the U. S. A., 21 States and the District of Columbia have electrocution; 15 States have hanging; one State gives choice of hanging or shooting; seven have life imprisonment and no death penalty, and five States employ the lethal chamber to execute criminals.

See CAPITAL PUNISHMENT; CROSS; DROWNING; ELECTROCUTION; GARROTE; GUILLOTINE; LYNCHING; PARRICIDE; PEINE FORTEET DURE; WHEEL, BREAKING ON THE.

Execu'tioner, the official who executes a death sentence ordered by a court. The office is an ancient one. In Rome its duties were divided between the lictors (q.v.), who seized and punished citizens, and the carnifex, who tortured and crucified slaves and foreigners. In the Frankish empire the execution of the death sentence usually devolved upon the accusing party, or upon the community which rendered the sentence. At a later period the *scharfrichter* and the *henker* were the official executioners, the former beheading the victim, while the latter carried out all other death sentences. In Great Britain the office was sometimes hereditary, and sometimes included in the duties of other positions. In recent times the London executioner has acted for all England. In France, this official is called *Monsieur de Paris;* and there the family of Sanson was long associated with the office.

In the United States the county sheriff is the executioner for his district in some States; in others, the warden of the State prison technically holds the office, though it is actually filled by some subordinate. Military execution is one of the duties of the provost marshal.

Execution of Deed. See DEED.

Executive, eg-zek'ū-tiv. In common language, the executive authorities in a state comprise all those persons and bodies which are engaged in directly enforcing or carrying out the provisions of existing laws, or, even more widely, all those representatives of the state who are not engaged in legislative or judicial functions. Some writers draw a distinction between *executive* and *administrative* authorities, the former being charged merely with the execution of the distinct injunctions of the law, while the latter have to decide the lines of policy on which the law is applied.

In the United States, the executive power possesses two distinct functions: (1) the political, such as the calling of a special session of Congress, the carrying on of diplomatic relations with foreign powers, the disposition of military forces; and (2) the administrative, which is concerned with the execution of statute law. The head of the Federal executive authority is the President, who, through his power of appointment and removal, controls the entire body of Federal executive officials, and directs their activities in the enforcement of the law. In the State governments, the executive is usually divided, the political function being exercised by the governor, while the administrative function is distributed among the governor, the heads of the chief executive departments (who are often elective, and thus quite independent of the governor), and local administrative officers, who are likewise often elective and non-removable by the central executive authority. See GOVERNMENT; UNITED STATES, *Government.*

Executive Officer, UNITED STATES NAVY, denotes the officer responsible for the business organization of the ship. He is a non-engineering line officer, and ranks next to the captain, for whom he acts as recruiting and equipment officer, takes charge of the records, the general fabric of the ship and boats, and has also a general supervision over the discipline, cleanliness, good order, efficiency, and trim appearance of the ship. He is in charge of the deck during general evolutions, and in battle generally supervises the battery, and watches over the safety and efficiency of the vessel.

Exec'utor, the person named in a will to carry out its provisions as to the disposition of the testator's property, and to act, when letters testamentary are issued by the court having jurisdiction, as his personal representative in all matters pertaining to the administration of his personal estate. The executor's duties are to attend to the proper interment of the testator; to probate the will and qualify as executor thereunder; to take possession of the testator's personal property, and make and file an inventory thereof in the court having jurisdiction of the probate of the will; to pay the funeral expenses and all other just debts and valid claims which come to his knowledge (if necessary, he may apply to sell real estate for this purpose); to advertise for

claims, so that all creditors may have notice of the death of the testator, and opportunity to present and prove their claims; to reject and contest any claims which he deems not to be just or legally due; to pay specific legacies or distribute any articles specially bequeathed; to sell the remaining property for cash and distribute it to the residuary legatees, or, with their consent and the approval of the court, to distribute it in kind; and to file an accounting of his proceedings as executor, and pray for his discharge.

The account of an executor may be contested by an interested person on the ground that he has been negligent or wasteful in his administration of the estate; or has not charged himself with all the assets of the estate; or has been guilty of official misconduct whereby the estate has suffered loss. An executor is usually required by statute to give a bond for the faithful performance of his duty, unless the will expressly provides that he shall not be required to do so; but even when the will contains such provision, if the executor named in the will is a non-resident the court may require him to give bond. He is an officer of the court, and subject to the court's direction at all times. Any person of full age and not under legal disability may be an executor; but a person named in a will as executor may refuse to serve. Not infrequently a trust company is named as executor; and in some States such a corporation qualifying as executor is not required to give bond. See ADMINISTRATION; WILL.

Exec'utory Contract. See CONTRACT.

Executory Devise, a gift by will of a future interest in real or personal property, which is not a remainder, either because it may take effect after or in derogation of a conditional fee, or because there is no preceding or 'particular' estate to support it. See DEVISE; REMAINDER; TRUSTS; WILLS.

Exegesis, eks-i-jē'sis, a Greek term meaning the exposition or interpretation of any writing, but almost exclusively used of the critical interpretation of the Holy Scriptures. The term *Hermeneutics* is sometimes employed to denote the interpretation proper or *discovery* of the true meaning of the text, while exegesis is more strictly the *exposition* of the meaning so discovered, and its practical doctrinal and moral application. In practice, the term exegesis includes both the study of the text or form in which the Scriptural revelation has reached us, and also the scope and doctrinal bearings of that text, and the conclusions that may reasonably be deduced from it. All exegesis of Scripture, however closely it follows the ordinary methods of literary and historical criticism, depends greatly upon the views entertained as to the nature and degree of inspiration, and the share of the conscious human element in the progressive revelation.

There are several distinct forms of exegetical writing. Of these, the simplest are the *gloss*, which explains or translates an unfamiliar or foreign word, and the *scholium*, which extends beyond the explanation of a single word to a phrase or sentence. The *commentary* undertakes to explain an entire writing, rather than isolated words and expressions; the *translation* goes a step beyond this, substituting for the Hebrew and Greek of the Old and New Testaments the language of the people, and thus making the Scriptures directly accessible to all; the *paraphrase* combines both translation and commentary.

In the history of exegesis two main currents may be discerned —the literal and the allegorical. When writings have come to be looked upon as weighty and authoritative, or are canonized as divinely inspired, exegesis becomes the indispensable medium of applying their teaching. This would *à priori* demand a *literal* interpretation; but as the message of a prophet or a legislator to his own time does not always answer the conditions of a later age, there arises the tendency to seek in his words an underlying sense, which gives birth to the *allegorical* method. The New Testament writers frequently allegorize the Old Testament (*e.g.*, Rom. ix. 7, 8; 1 Cor. ix. 9; Gal. iv. 24, 'which things are an allegory'); and even when they aim to interpret literally, they often deduce from the quoted text a meaning different from the original (notably Matthew — *e.g.*, ii. 15, 'Out of Egypt have I called my son'). This allegorizing habit was partly a native Jewish growth, being used to make an arbitrary reconciliation between the traditions of Hebraism and the results of Greek philosophy; and partly an appropriation of Greek usage in connection with the interpretation of Homer. It finds its classical exponent in Philo (q.v.).

The allegorical method of exposition was much employed by the Gnostics, and became a special feature in the Alexandrian school (Clement, Origen, etc.). A preference for the literal method distinguishes the Antiochean school, founded by Diodorus of Tarsus, and carried on by such men as Lucian and Theodore of Mopsuestia. The former, with modifications, was continued by Augustine, Gregory the Great, and others; the latter by Chrysostom, Basil, Gregory Nazianzen, and Gregory of Nyssa, as also by Jerome.

In the Middle Ages, exegetical work made little advance. It was mainly confined to the *seirai* or *catenæ*, collections of the views of the fathers (Cassiodorus, Aquinas, etc.), and its chief tendency was toward the building up of a traditional interpretation of the Scriptures. The transition to the modern period was made by Nicolus of Lyra, who in his *Postillæ* emphasizes the literal sense; and the humanists (*e.g.*, Reuchlin and Erasmus), who begin in earnest to make philological investigation. The Reformation exegetes—Luther and Melanchthon, as well as Zwingli, Calvin, and Beza—are professedly literalists, but all alike labored under the necessity of finding Scriptural support for their doctrines.

During the seventeenth century exegesis was employed chiefly for the affirmation or denial of various doctrinal beliefs, and extensive contributions of this character were made by both Roman Catholic and Protestant writers. Among the outstanding names is that of Grotius (q.v.), who issued *Annotationes* to both the Old and New Testaments.

The revival of a real exegesis, about the middle of the eighteenth century, was due mainly to Ernesti and Semler, whose inspiring impulse created a school of men who, in a single generation, contributed more to a sound knowledge of the Scriptures than all the theologians of sixteen centuries. Such were Gesenius, Ewald, Olshausen, and Böttcher (Hebrew); Winer, Buttmann, Lachmann, and Griesbach (Greek).

It remained for the nineteenth and twentieth centuries to furnish the realization of a true philological and historical exegesis. Discoveries in Assyria and Egypt have cast a flood of light and confirmation upon the ancient history contained in the Bible; while the study of New Testament history and of the life of our Lord—so characteristic a feature of the more modern theology—has contributed no less to our knowledge of the scope and contents of the New Testament books. Alford, Lightfoot, Ellicott, Jowett, Perowne, A. B. Davidson, Cheyne, Driver, Bennett, Kennedy, Peake, and Charles are a few of the many distinguished exegetes of recent times. In Germany, Great Brit-

ain, and the United States a noteworthy feature of the time is the serial treatment of the Bible by groups of scholars—*e.g.*, *Kurzgefasstes Exegetisches Handbuch zum Alten Testament* (1841 *et seq.*), *zu den Apocryphen* (1851 *et seq.*), by Grimm and Fritzsche; *zum Neuen Testament* (1836–48), by De Wette; *International Critical Commentary* (1895 *et seq.*); *The Messages of the Bible* (1899–1911); *Bible for Home and School* (1908–13).

The educational movement in Sunday school work in America and Great Britain has led to the preparation of various exegetical works of a popular character for the use of teachers and adult pupils—*e.g.*, *The Cambridge Bible for Schools and Colleges* (1878–1901), the *Expositor's Bible* (1888 *et seq.*), the *Century Bible* (1901–13), and the *Encyclopædia of Sunday Schools* (1915); as well as numerous handbooks and notes on the Sunday school lessons.

See BIBLE; also the separate articles on the books of the Bible, and the biographies of the exegetes mentioned. Consult Farrar's *History of Interpretation;* Cave's *Introduction to Theology;* Briggs' *Study of the Holy Scriptures.*

Exelmans, eg'zel-mans, REMY JOSEPH ISADORE, COMTE (1775–1852), marshal of France, born at Bar-le-Duc. In 1791 he entered the army, and served under Macdonald and Championnet in the campaign of Naples, and under Murat in Spain, where he was taken prisoner and sent to England (1808–11). Escaping, he served with Napoleon in the Russian campaign (1812), and was made general of division for his bravery. He was banished from France on the downfall of the Emperor, but was allowed to return in 1823, and was restored to his rank by Louis Philippe (1831). In 1851 Louis Napoleon created him marshal.

Exemp'tion Laws. See HOMESTEAD LAWS.

Exequatur, ek-si-kwā'ter, in international law, the official recognition or warrant given to an officer of the rank of consul or consul-general by the government of the country in which he has to exercise his functions. An exequatur may at any time be withdrawn at the discretion of the government of the state to which the consul is accredited. See CONSUL.

Ex'ercise, the practice of proper forms of physical activity, is an important element in sustaining health and in preventing and curing disease. The general effects of systematic exercise are increased circulation, improved digestion, and the incitement of a greater demand for food and sleep, all of which tend to establish a natural defence for the body. Exercise should be adapted to the existing physical conditions, as it is dangerous if employed during attacks of chronic or acute disease, except as definitely prescribed, or if indulged in excessively. Massage, electricity, and apparatus of various kinds are employed to meet the needs of persons unable to take active exercise. In general, outdoor exercise is more beneficial when taken in connection with an interesting pastime, such as golf or lawn tennis. See GYMNASTICS; PHYSICAL TRAINING. Consult Woods Hutchinson's *Exercise and Health* (1911).

Exeter, eks'i-ter, city, parliamentary, municipal, and county borough, and seaport in Devonshire, England, on the River Exe; 8 miles from its mouth in the English Channel; 170 miles by rail southwest of London. On the southeast is the suburb of Heavitree, and on the opposite side of the river, on the west, that of St. Thomas. Considerable portions of the ancient walls still remain. The chief object of interest is the Cathedral, a grand cruciform structure begun in 1112 by Bishop Warelwast, and dedicated in 1351. Measuring 408 feet by 76 (or 140 across the transepts), and 66 feet high, it is a long, low edifice, with massive transeptal towers. The massive Norman towers standing on the north and south sides were opened below in the thirteenth century to form transepts, and the main structure was subsequently transformed from the Norman to the Decorated style of architecture. The episcopal throne is a remarkable construction in oak. Other ancient buildings are the Bishop's Palace (fourteenth century); the Hall of the College of Vicars, incorporated 1401; remains of a Norman castle, probably the representative of still earlier Roman and British strongholds; and the Guildhall, erected in 1330, with Elizabethan façade (1588). There are some interesting examples of old domestic architecture. The Northernhay is a kind of boulevard near the castle. The chief manufactories are paper mills, iron and brass foundries, flour mills, tanneries, and breweries. The manufacture of woollen goods, formerly very important, is now extinct. Area (city), 4,705 acres; pop. (1901) 47,185; (1937 est.) 69,240.

Exeter, town, New Hampshire, a county seat of Rockingham county, on the Squamscott River, and the Boston and Maine Railroad; 25 miles east of Manchester. The river supplies water power which is utilized in the manufacture of machinery, iron and brass goods, shoes, boxes, automobile tubes, asbestos, and rubber novelties. It is the seat of Phillips Exeter Academy (q. v.) and of Robinson Female Seminary. It was founded in 1638 by Rev. John Wainwright; it was attacked by the Indians in 1690 and 1709. Pop. (1900) 4,922; (1910) 4,897.

Exeter, borough, Luzerne county, Pennsylvania, on the Susquehanna River, and the Lehigh Valley Railroad; 10 miles west of Scranton. It has coal mining interests. Pop. (1900) 1,948; (1910) 3,537.

Exeter Book, THE, or CODEX EXONIENSIS, a folio MS. given by Bishop Leofric to the library of his cathedral between 1046 and 1073, and dating probably from the first half of the same century. It contains poems whose dates of composition vary from that of *Widsith,* which is certainly older than *Beowulf,* to that of some late poems, which are probably not much older than the MS. One is probably by Cynewulf; another almost certainly so; while the third is an independent text of the Song of Azarias in the *Daniel* of the 'Junian Cædmon.' The best of the *Riddles* are probably by Cynewulf: many of them are original; several are recast from Latin riddles by Ealdhelm and others. Nos. 16–18 are part of an Old English *Physiologus.* The *Gnomic Verses* contain a kind of 'platitudinarian' philosophy.

Exeter College. See OXFORD.

Exeter Hall, a large building on the north side of the Strand, London (No. 372); let chiefly for religious and philanthropic assemblies, lectures, sacred concerts, etc. In 1880 it was purchased and presented to the Young Men's Christian Association, whose headquarters it remained till 1907, when it was sold and demolished. 'Exeter Hall' has been used as a term of opprobrium to indicate the views of extreme religionists toward certain questions of public policy.

Exhaust'. See GAS ENGINES; MOTOR CARS.

Exhibitions, eks-i-bish'unz, or EXPOSITIONS. The idea of exhibitions, which have had so important an influence on the advancement of manufacturing art, may be traced back to the fairs (see FAIR) held in the various European countries during their earlier history. The modern development of the idea is generally credited to the French, who held the first great exhibition in Paris in 1798, although, previous to this, the London Society of Arts had held a show of agricul-

Exhibitions

tural and other machinery (1756), and there had been a small exhibition in Prague (1791). Between 1798 and 1850 numerous smaller exhibitions were organized. Eleven were held in Paris, four in England, and a series of triennial expositions were inaugurated in Dublin.

The era of great international exhibitions began with the opening of the *World's Fair* in the 'Crystal Palace,' Hyde Park, London, on May 1, 1851. The exhibition building, with the exception of the flooring and joists, was entirely of glass and iron. Its total length was 1,851 feet, corresponding with the year; the entire area was 772,784 square feet; and the cost was $880,000. The exhibition was open for a period of twenty-three weeks; was visited by 6,170,000 people; and the receipts amounted to $2,525,000, leaving a surplus of about $750,000. The building was afterward removed to Sydenham, where an estate was purchased at South Kensington, on which subsequently the South Kensington Museum, the Royal Horticultural Society's Garden, the Albert Memorial Hall, and other institutions were placed.

In 1855 the *Paris International Exhibition* was held; but, although popular was not profitable. At this exposition, for the first time, international collections of pictures formed an important feature.

In 1867 a second *Paris Universal Exhibition* was held on an extensive scale. A portion of the ground was enclosed for reproductions of national habitations, and the domestic life of the various nationalities was illustrated by families brought from every part of the globe. The attendance numbered 6,805,696, and the receipts amounted to $2,047,506.

The *International Exhibition of Vienna*, held in 1873, was the largest and most important exposition that had yet been held. It was visited by 6,740,500 people during six months.

The *International Centennial Exhibition* was held in Philadelphia, Pa., from May 10 to Nov. 10, 1876. It celebrated the hundredth anniversary of American Independence, and illustrated the progress and industrial development which had taken place since that event. On a site in Fairmount Park, covering 236 acres, more than 200 structures were erected, five of which were large exhibition buildings. The admissions were 9,910,966, of which 274,919 entered on Pennsylvania Day (Sept. 28). (See CENTENNIAL EXHIBITION.)

The Centennial Exhibition was surpassed, in its turn, by the *Paris Exhibition* of 1878, on the opening day of which 111,955 visitors were admitted. The main building, rectangular in form, covered 27,900 square yards, enclosing a court occupied by the art galleries and other special exhibits.

The *Colonial and Indian Exhibition* and the *Liverpool Exhibition* were held in 1886 and in 1888 the *Glasgow Exhibition* was open for one hundred and sixty-one days with an attendance of 5,748,379.

In 1889 another great *Universal Exhibition* surpassing all its predecessors was held in Paris. It occupied a site of 173 acres, with the famous Eiffel Tower as its principal attraction. Noteworthy buildings were the palace of industries, with a central dome 195 feet in height, and the twin palaces of the fine and liberal arts, each with a cupola 183 feet high.

The next great exhibition was the *World's Columbian Exposition*, held in Chicago, Ill., from May 1 to Oct. 30, 1893, to commemorate the fourth centenary of the discovery of America. It was called the 'White City,' and was memorable for the architectural merit of its buildings. These represented the efforts of the most celebrated architects in the United States, and were an important influence in the general improvement of public buildings. It was also noteworthy for its statuary, the work of leading American sculptors being exhibited. The exposition occupied 666 acres on the shore of Lake Michigan, and included about 150 buildings. The total attendance was 27,539,041, and the total receipts were $33,290,065. (See WORLD'S COLUMBIAN EXPOSITION.)

The *California Midwinter Fair*, held in San Francisco, Cal., from Jan. 27 to July 4, 1894, and called the 'Palm City,' was organized to give an opportunity to foreign exhibitors at the Chicago World's Fair to display their goods on the Pacific Slope. The site included 160 acres of Golden Gate Park, and there were five principal buildings, designed in the Spanish Renaissance style.

The *Cotton States Exposition*, having for its chief purpose the exhibition of the agricultural, mineral, and manufacturing resources of the Southern States, was held in Atlanta, Ga., from Sept. 18 to Dec. 31, 1895. The site covered 189 acres in Piedmont Park, and there were thirteen large exhibition buildings. The cost was $960,930, and the attendance 1,179,889.

The *Tennessee Centennial Exposition*, called the 'Centennial City,' celebrating the one hundredth anniversary of that State, was held in Nashville, Tenn., from May 1 to Oct. 30, 1897. The site covered about 200 acres of West Side Park and adjoining property, on which were erected fourteen principal buildings. The attendance was 1,786,714; the expenditures and receipts approximately $1,100,000. (See TENNESSEE CENTENNIAL EXPOSITION.)

The *Trans-Mississippi Exposition*, exhibiting the products, industries, and civilization of the States west of the Mississippi, was held in Omaha, Neb., from June 1 to Oct. 31, 1898, and was known as the 'Magic City.' There were twelve principal structures, including an Arch of States, forming the chief entrance, grouped around a waterway or lagoon. The Congress of Indians, a rare ethnological exhibit of the vanishing aboriginal people of the United States, and a peace congress, in recognition of the victories of the U. S. Army and Navy over the forces of Spain, were conspicuous. The exposition was visited by 2,613,508 people, and the receipts were $1,924,078. (See TRANS-MISSISSIPPI EXPOSITION.)

In 1900 there was another *Paris Exhibition*, promoted by the French Republic, with a guarantee of $8,000,000. On one side of the Seine were the special buildings devoted to science, art, education, and the industries; on the other side were the naval and military exhibits, the various national buildings, and the palaces of foreign industry and decorative art. The attendance was 50,860,801.

The *Glasgow Exhibition* of 1901 proved highly successful. The income was $2,013,705, with a profit of $176,080. The admissions numbered 11,497,220.

The *Pan-American Exposition*, celebrating the progress of civilization in the Western Hemisphere during the nineteenth century, was held in Buffalo, N. Y., from May 1 to Nov. 2, 1901. The site covered 350 acres, and there were thirteen principal buildings, mostly in the Spanish Renaissance style. The electrical displays and the unique color treatment of the buildings gave the exposition the name of the 'Rainbow City.' The assassination of President McKinley (q.v.) marred its success, however. The receipts were $5,478,590, and the attendance was 8,120,048. (See PAN-AMERICAN EXPOSITION.)

The *South Carolina Interstate and West Indian Exposition*, called the 'Ivory City,' to demonstrate the new industries and commerce of the South, was held in Charleston, S. C., from Dec. 1, 1901, to June 1, 1902. The site included 250 acres, on which were seven principal buildings. The attendance was less than

500,000, and the receipts failed to equal the costs.

The *Louisiana Purchase Exposition*, commemorating the centenary of the acquisition of the Louisiana territory from France, was held in St. Louis, Mo., from April 30 to Dec. 1, 1904. It covered 1,300 acres, and there were fifteen large exibition buildings. A noteworthy feature was the Congress of Arts and Sciences, at which a summary of the world's progress in knowledge was presented by papers distributed among seven divisions and twenty-four departments. The anthropological exhibits, especially those from the Philippines, were also notable. The cost was $31,586,331, and the recorded admissions were 19,694,855. (See LOUISIANA PURCHASE EXPOSITION.)

The *Lewis and Clark Exposition*, commemorating the centenary of the exploration of the Oregon country by Captains Meriwether Lewis and William Clark (qq.v.), was held in Portland, Ore., from June 1 to Oct. 15, 1905. The site covered 406 acres, and there were eight principal structures. The attendance was 2,545,509. (See LEWIS AND CLARK CENTENNIAL EXPOSITION.)

The *Jamestown Tercentenary Exposition* was held from April 26 to Nov. 30, 1907, at Hampton Roads, Va., under the patronage of the U. S. Government. The most notable feature was the remarkable marine display. Two great piers, each 2,000 feet long, were erected, and many foreign warships were present. The cost of the exposition was about $10,000,000, and the attendance was 2,850,000. (See JAMESTOWN TERCENTENARY EXPOSITION.)

The *Alaska-Yukon-Pacific Exposition*, held at Seattle, Wash., from June 1 to Nov. 30, 1909, was organized to illustrate the resources of the great Pacific Northwest. The attendance was 3,740,561, and the total cost $10,000,000. (See SEATTLE.)

The *Brussels Exposition*, Belgium, was held from April 23 to Nov. 14, 1910, and occupied a site of 200 acres on the west side of the city. The buildings were chiefly copies of historic structures, the official pavilion of Antwerp being a reproduction of the house of Rubens. The exhibits were included in artistic, scientific, industrial, commercial, and colonial sections, and represented many nations, including the United States. The attendance was approximately 13,000,000. (See BRUSSELS EXPOSITION.)

Turin Exposition.—The fiftieth anniversary of the establishment of the kingdom of Italy was celebrated by an exposition held in Turin from April 30 to Oct. 31, 1911, with exhibits showing the development in art, science, and technology in Italy, as well as the resources of the world. A site of 250 acres was chosen in Valentino Park, and there were 125 buildings in all. Many foreign governments, including the United States, participated. Contemporaneously there was an exhibition in Rome (March 27 to Dec. 1), at which exhibits devoted to history, archæology, and art were displayed.

In 1913 the *Ghent Exposition*, Belgium occupied a site of 250 acres. Notable exhibits were those of fine arts, horticulture (the flower show), and archæology, and of the Congo.

The *Panama-Pacific Exposition*, to celebrate the opening of the Panama Canal, was held in San Francisco, Cal., from Feb. 20 to Dec. 4, 1915. It occupied an area of about 625 acres on the south front of San Francisco Bay, just inside the Golden Gate. There were eleven main buildings, in the Spanish American or Mission style of architecture, grouped around a central Court of the Sun and Stars, at the entrance of which was the famous Tower of Jewels. More than 250 groups of statuary adorned the grounds, and the display of flowers surpassed that of any previous exposition. A large number of congresses and conventions were held. (See PANAMA-PACIFIC EXPOSITION.)

The *Panama-California Exposition*, also celebrating the completion of the Panama Canal, was held in San Diego, Cal., from Jan. 1 to Dec. 31, 1915. It occupied an area of about 615 acres in Balboa Park, reached by the Puente del Cabrillo, a picturesque bridge 135 feet high and 900 feet long. There were ten principal buildings in the Spanish Colonial style, each of which was a reproduction or simulated some historic building, such as the Alhambra or the old Mexican cathedral. The exhibits were largely devoted to the archæology, ethnology, and natural history (especially botany) of the Southwestern part of the United States. (See PANAMA-CALIFORNIA EXPOSITION.)

The *Panama National Exposition*, celebrating the discovery of the Pacific Ocean by Balboa, was held in the city of Panama, February-June, 1916. A site of 50 acres, known as 'El Hatillo' was occupied by seven principal structures and the most important feature of the exposition was the exhibition of the natural resources of Panama.

The *Brazilian Exposition*, celebrating the hundredth anniversary of the independence of Brazil, was held in Rio de Janeiro, Sept. 7, 1922 to March 31, 1923. A beautiful site along the water front was occupied by many buildings containing exhibits pertaining to Brazilian industries and resources, and by thirteen foreign buildings, representing Argentina, the United States, Japan, England, Czechoslovakia, Italy, and others. Contemporaneously with the exposition, a number of international congresses were held.

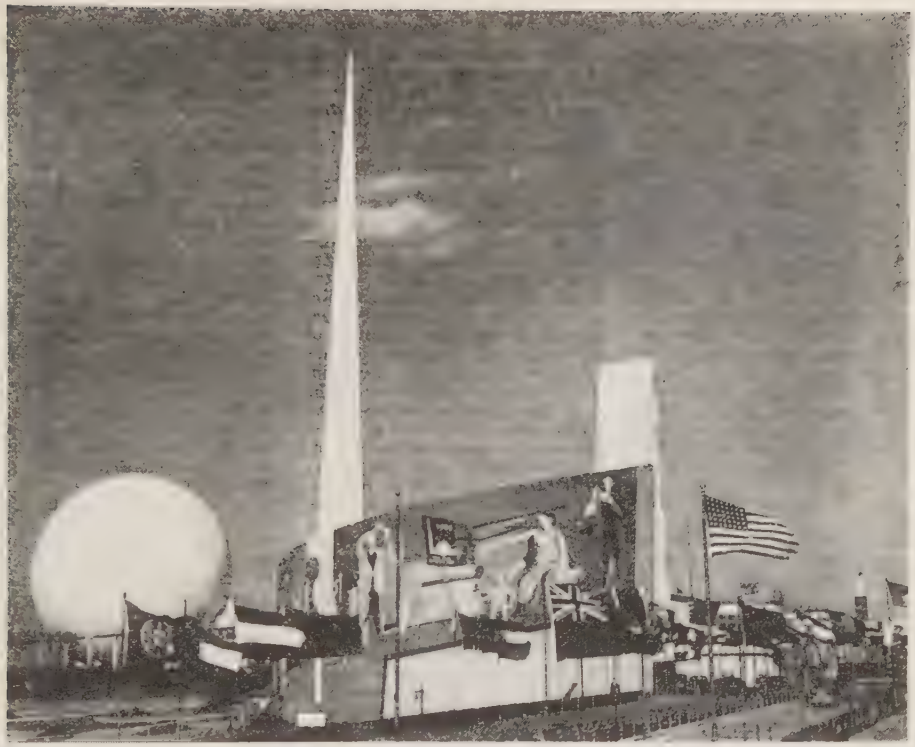
A *Tokyo Peace Exposition*, commemorative of world peace and emphasizing Japan's industrial progress was held in Tokyo, March-July, 1922. A feature of the exhibition was a building devoted to exhibits from Germany, Italy, Great Britain, the United States, and Switzerland.

The *British Empire Exposition*, held at Wembley, 1924–25, was the largest one of its kind ever held in Great Britain. Its site covered 220 acres, the total attendance for both seasons was more than 28,000,000, and the cost of the whole was nearly £12,000,000 (See BRITISH EMPIRE EXPOSITION).

The *International Exposition of Decorative Arts and Modern Industries* was held in Paris, April-October, 1925. A site of 57 acres on the banks of the Seine was occupied by exhibits grouped in five classes: architecture; furniture; wearing apparel; theatrical, street, and garden architecture and decoration; and education.

The *Sesquicentennial Exposition*, commemorating the sesquicentennial of the signing of the Declaration of Independence was held in Philadelphia, June-December, 1926. A site of 275 acres in League Island Park was occupied by two very large and many smaller buildings. (See SESQUICENTENNIAL INTERNATIONAL EXHIBITION.)

A *Century of Progress Exposition* was held in Chicago, Illinois, in 1933 and 1934. The exhibit structures were built on reclaimed ground in downtown Chicago along the shore of Lake Michigan. The site extended some three and a half miles, from Twelfth Street to Thirty-ninth Street, representing an area of 427 acres. During its two years of operation, the exposition was visited by 48,769,227 people. In architecture the buildings constituted a radical departure in design and lighting. The most imposing building, the Hall of Science, accommodated 80,000 persons and contained exhibits of mathematics, physics, chemistry, biology, geology, and medical science. The most spectacular structure was the "Sky Ride," which was composed of two steel towers connected at an ele-



Courtesy New York World's Fair

PERISPHERE AND TRYLON AT NEW YORK WORLD'S FAIR. HALL OF PHARMACY IN THE FOREGROUND

Courtesy New York World's Fair 1939, Inc.

COSMETICS BUILDING, NEW YORK WORLD'S FAIR 1939

vation of 200 feet by cables upon which cars traveled back and forth. The exposition's board of control spent $4,783,839 in operating the fair during its 170 days in 1933. More than $37,000,000 was spent by visitors in admissions. The success of the 1933 season resulted in the reopening of the exposition in 1934. "A Century of Progress," operating in a time of economic depression, tended to stimulate business conditions. It was estimated that jobs for more than 100,000 persons were created by the fair in the city of Chicago alone.

The *San Diego Exposition* followed the Chicago exposition in the city of its name in 1935. It was designed to celebrate the 156 years of the city's existence and growth.

The *Texas Centennial Exposition* was held in 1936 and was a state-wide exhibition in which the cities of Dallas, Fort Worth, and Houston featured as focal points.

The *Great Lakes Exposition* was held in Cleveland, Ohio, in 1936 to celebrate the centennial of that city. It drew strongly on the Middle West and the Great Lakes region for its exhibits.

The *Paris International Exposition*, held in Paris, France, in 1937, was the most notable of foreign fairs. The city was host to visitors who came from all over the world. Some 30,000,000 persons attended, and more than forty nations were represented by exhibits. The exposition was situated along the river Seine. Regional centers representing the provinces lined the banks, while the colonial section occupied the Isle of Swans in the middle of the river. Illuminated water displays at night along the Seine were doubtless the most spectacular feature of the fair. Visitors were carried to and from the various pavilions in motor launches. The New Trocadero and the Museum of Modern Art were permanent structures retained after the closing of the exposition.

The *Empire Exposition* was held in Glasgow, Scotland, in 1938. Bellahouston Park was the site, and its unique ground design, composed of varying levels, enabled the architect to achieve new and interesting building patterns. The exposition as a whole was a remarkably unified presentation of the industrial, commercial, and cultural successes of the Empire. It was visited by more than 12,000,000 persons.

The *Golden Gate Exposition* was opened on February 15, 1939, in the city of San Francisco to celebrate the completion of the Golden Gate Bridge and the San Francisco-Oakland Bay Bridge. A number of foreign nations sent exhibits, but for the most part the principal concessions were held by countries of the Pacific, including Australia, New Zealand, the Philippine Islands, and many of the South and Central American Republics. The buildings were designed to combine features of Oriental and Western culture and architecture. At the summit of the 400-foot Tower of the Sun, the highest structure of the Exposition, was placed a golden phoenix to symbolize San Francisco's rebirth from the ashes of its great fire of 1906. A number of buildings were erected by the state of California to show the history of its development and its present role in American society. More than seven acres of exhibits were installed in the U. S. Federal Building, depicting, among other things, American history, the functions of the Works Progress Administration, and the Federal programs for conservation and national defense. More than $20,000,000 worth of the most renowned painting and sculpture of the world was assembled for the exhibit of Fine and Decorative Arts. The total cost of the Golden Gate Exposition was estimated to exceed $50,000,000.

The *New York World's Fair* was opened to the public April 30, 1939. The site selected was an area of swampland of 1,216 acres at Flushing, Long Island, in New York City's Borough of Queens. This area was reclaimed by draining and filling, and after the closing of the 1940 season was turned into a public park. The theme of the fair was summed up in the phrase, "The World of Tomorrow." It expressed in exhibits and concessions the type of civilization which can be created in the future by the technical tools and social elements already in existence. Architecturally, the fair represented a departure from conventional modes. The Theme Center was the Trylon and Perisphere, the former a three-sided slender obelisk that rose to a height of 700 feet, the latter a hollow globe more than 18 stories high and a city block in diameter, containing a great diorama of the well-planned city of the future. The attendance for the first six months of the fair was 25,817,265. Sixty nations and international organizations contributed to the exposition a great variety of exhibits and pavilions. Indeed, more than 200 structures were erected, and more than 280 acres were devoted to recreational activity alone. The exhibit area was located along the axis of Constitution Hall, an avenue extending from the United States Government building westward to the Theme Center. Specifically, the theme was developed by dividing the major activities of the fair into seven groups as follows: Transportation, Production and Distribution, Food, Health, Education and Science, Community Interests, and Communications and Business Systems. The buildings which housed these undertakings were arranged in sections radiating from the Theme Center. The structures in each class of exhibits were distinguished by a particular color, deepening in intensity from the Theme Center to the periphery of the exhibit section. While various estimates have been made of the cost of the fair, the most reliable calculations indicate that the total investment was in excess of $150,000,000. The New York World's Fair was reopened for its second season on May 11, 1940. In preparation for the second season, the amusement section was enlarged and the educational exhibits made more attractive. Prices which had been criticized as exorbitant in 1939, especially those on food, were radically reduced.

Exhumation, eks-hū-ma'-shun, the disinterment of a dead body. The act done without warrant from the proper authority, is a misdemeanor at common law. In some States of the United States the offence is also dealt with by statute. See articles under POSTMORTEM; RESURRECTIONISTS.

Ex'ile. See BANISHMENT.

Ex'ile, Jewish. See ISRAEL, HISTORY OF.

Ex Libris, eks lī'bris, a favorite inscription on book plates, denoting that the volume is one of the collection of the person owning the bookplate. See BOOKPLATES.

Ex' moor, high moorland and ancient forest, England, near the Bristol Channel, on the borders of Somerset and Devon. Red deer are protected and the uplands are devoted to sheep pasture and the breeding of ponies. Romantic Lynton, Porlock, and Dulverton have become familiar by the Exmoor

Courtesy San Francisco Golden Gate International Exposition

ELEPHANT TOWERS FLANKING THE MAIN ENTRANCE TO THE GOLDEN GATE INTERNATIONAL EXPOSITION

Courtesy San Francisco Golden Gate International Exposition

PACIFIC HOUSE AT THE GOLDEN GATE INTERNATIONAL EXPOSITION

romance *Lorna Doone* (Blackmore). Many barrows mark the resting-places of prehistoric people.

Exmouth, market town and popular seaside resort, England, in Devonshire; 10 miles south of Exeter. It was reputed a flourishing port early in the 13th century and sent ten ships to the siege of Calais (1347). Afterwards it fell into decay, and only revived at the beginning of the 18th century. The leading industries are fishing, brick-making and the manufacture of Honiton lace. Pop. (1921) 13,606.

Exmouth, Sir Edward Pellew, Viscount (1757–1833), English admiral, was born in Dover. He fought in the battle of Lake Champlain in 1776, and commanded a naval brigade in Burgoyne's campaign in 1777. In 1793 he was in command of the *Nymph* when she captured the French frigate *Cléopâtre.* In 1794 he shared in the capture of four French frigates by Warren's squadron. On becoming an admiral (1814), he was raised to the peerage as Lord Exmouth. In 1816 he bombarded Algiers, effecting the abolition of Christian slavery in the dey's dominions.

Exodus, Book of, the second book of the Old Testament, whose name is of Greek derivation, meaning 'departure.' The book is naturally divided into three parts: the first part (chapters i. to xviii.) is historical, describing the enslavement of the children of Israel in Egypt, the birth and upbringing of Moses, his mission as deliverer of his race, the ten plagues, the institution of Passover, and the departure from Egypt; the second part (chapters xix. to xxiv.) is legislative, narrating the giving of the law on Sinai, and the confirmation of the Mosaic covenant; the third part (chapters xxv. to xl.) is chiefly constructive, narrating the orders respecting the tabernacle, the consecration of Aaron's family as priests, the making of the golden calf and the resulting punishment, and finally the building of the tabernacle. Exodus is a compilation by various editors from documents of different date, its sources, according to Driver and other authorities, being the same as those of Genesis. The sources, P, or the Priests' Code, J, and E, are generally readily recognizable; the last two are not always easily distinguishable in the legislative sections. Consult B. W. Bacon's *The Triple Tradition of the Exodus.*

Exodus, The, the departure from Egypt and the journey to Palestine of the children of Israel, described in Exodus, Leviticus, Numbers, Deuteronomy, and Joshua. The exodus probably occurred during the reign of the Pharaoh Meneptah or Seti II, and information now available regarding Egyptian life and customs substantiates the general accuracy of the local coloring in the Bible narrative.

Exog'amy, the antithesis of endogamy, prohibits the marriage of a man with a woman of his own clan. When, as is sometimes the case, exogamy is restricted to chiefs, this is done with the twofold purpose of forming alliances with tribes that would otherwise be inimical, and at the same time to avoid the formation of one all-powerful *gens* within the tribe. The most potent impulse which has led to the institution of exogamy has undoubtedly been the desire to introduce new blood into the stock. One outcome of exogamous laws was the practice of marriage by capture and traces of this ancient and barbarous custom are discernible at the present day even among highly civilized nations. For a special inquiry into the subject, consult J. F. M'Lennan's *Studies in Ancient History,* second series (1896). Also Morgan's *Ancient Society.*

Exogens, plants in which new wood bundles are annually formed outside the old wood by the activity of a layer of cambium between the inner bark and the wood. (See Bark.) Exogenous plants are often known as dicotyledons. Common examples are the oak and the elm. In an exogenous stem a cross section shows a series of rings of wood around the pith and surrounded

Stem of Exogen (cross section)

by the bark. At the end of the first year's growth the wood has formed a tube around the pith, traversed by plates of parenchyma, which is cellular tissue similar to the pith. Radiating from the pith, these divide the wood in wedges: they are called 'medullary rays.' These rays form what is especially conspicuous in maple and oak—*viz.* the 'silver grain,' visible in the lustre of the wood when cut.

Exophagy, that form of cannibalism which prohibits the eating of one's own kindred or tribesmen, this latter practice being known as endophagy.

Exophthalmic Goitre. See Goitre.

Ex'orcism, the ceremony of casting out 'demons,' or, in modern language, 'disease,' from the bodies of persons variously afflicted. The faculty of exorcising has always been vested in certain castes or races. Thus, in Shetland tradition, nobody but a Finn wizard from Norway had the power to cure toothache, which he did by conjuring it out of the patient's body and forcing it to enter a stone. In some races only special castes have the required power. This applies to Gypsies as well as to Finns and others. The rites used in the mediæval Church of Rome for exorcising the devil and malevolent spirits are described in Stampa's *Fuga Satanæ Exorcismus* (1608). Its use in modern times is comparatively rare and is seldom employed except in the rite of baptism in the Roman Catholic Church.

Exosto'sis, in surgery, an unnatural, circumscribed, bony outgrowth or enlargement, growing from bone only. Surgeons describe two forms—the 'cancellous' and the 'compact,' named according to the density of the tumor. The cancellous exostoses are found on long bones, such as the thigh bone or a toe joint. The compact or ivory exostoses occur mostly on the head and face. Both forms are better left alone, unless they cause pain by pressure, or interfere with movement, as when near a joint. But if removal is decided upon, it must be complete, otherwise the tumor will return.

Exotic Plants, those which belong naturally to climates other than that in which they are being cultivated.

Expansion, one of the most general results of the rise of temperature of matter, all gases and most solids and liquids increasing in size when made hotter. The coefficient of linear expansion of solids, or fraction of their length at 0° C., by which they increase for 1° rise of temperature, is determined by measuring the increase in length of a bar of material when heated from one temperature to another, either by a microscope with a micrometer scale, or more simply still by a micrometer screw-gauge, such as the spherometer. The coefficients of superficial and of cubical expansion are equal to twice and three times the linear coefficient respectively.

The expansion of liquids is complicated by the simultaneous increase in the size of the vessels

containing them, which reduces the real expansion. Thus, the coefficient of 'apparent' expansion, which can be determined by weighing the overflow from a vessel with a narrow neck that has been filled with the liquid at a lower temperature and then heated to a higher one, is smaller than that of the real expansion, which is measured by balancing a column of the hot liquid against the cold. The hot liquid, being less dense, requires a height that is greater by the amount of the expansion, in order to balance the cold liquid, from which a coefficient can be calculated which is independent of the size and shape of the vessel.

Gases expand far more than liquids or solids, and, unlike them, expand more regularly, and practically all to the same extent. Thus, the coefficient of expansion of air is .00367, which is about twenty times as great as that of mercury, seventy times as great as that of brass, and almost exactly the same as that of any other gas. As the volume of gases varies inversely as the pressure, the coefficient of expansion can be determined either by keeping the pressure constant, and measuring the increase of volume caused by a rise of temperature, or by keeping the volume constant, and finding the increase of pressure, both methods leading to the same result.

Probably the chief application of expansion is for measuring temperatures; and though, theoretically, gases are the most suitable and solids the simplest, liquids—particularly mercury—are used most frequently, a common thermometer being simply an instrument for measuring the volume of a particular quantity of mercury. The expansion of solids is mainly important on account of the great forces that are brought into play when it, or the reverse, contraction, takes place, the force required to prevent it being that which is needed to extend or compress the material to the same extent. This is utilized in shrinking on wheel tires, gun jackets, etc., and must be provided for in structures such as bridges, roofs, condenser tubes, or hot-water pipes, to prevent damage. The difference of coefficient of expansion of different metals is sometimes employed in making thermometers, compensation balances for watches, and invariable pendulums for clocks.

With liquids and gases, one of the main results of expansion is the formation of 'convection' currents that are caused by the warmed portion of the gas or liquid becoming lighter as it expands, and hence rising. This plays an important part in the production of ocean currents and winds, and is usefully employed in heating buildings by hot water, in the draught of chimneys, and in ventilation. See HEAT.

Expan'sion (in mathematics), the expression of a function in terms of a series of other functions. Various theorems exist for this purpose, such as Taylor's theorem for expanding a function of one or more variables in terms of ascending powers of the variables, Fourier's theorem for expanding a periodic function in a Fourier series, and others. See FOURIER SERIES.

Expa'tria'tion, the act of voluntarily giving up citizenship or allegiance in one's own country and becoming a citizen or subject of another. The right of a person to make such transfer of allegiance is known as the right of expatriation. Much discussion has centred about this matter. It was finally decided in the United States by act of July 27, 1868, which states that the right of expatriation is inherent in all persons. It denies, moreover, the claim of foreign states, that those who have become naturalized American citizens are nevertheless subjects of the foreign states, and gives to naturalized citizens of the United States in foreign countries the same protection as to native Americans. Practically all foreign powers also allow the right of expatriation, generally making the fulfilment of military service a prerequisite.

Certain treaties between the United States and European countries, entered into since the act of 1868, grant to citizens and subjects the right of expatriation, with certain conditions and qualifications. In case of conflict between any treaty and the act, the treaty is final. No expatriation is legal which is not for a lawful purpose, and expatriation may not take place in time of war.

A citizen of the United States naturalized in a foreign state is automatically expatriated (Act of March 2, 1907). See ALIEN; ALLEGIANCE; CITIZENSHIP; NATURALIZATION.

Expectation of Life. See ANNUITY; INSURANCE, LIFE.

Expec'torants, in medicine, a term used to denote those agents which influence expectoration. They act in various ways. Some, such as steam inhalations, increase the secretions of the respiratory passages, and facilitate the expectoration of tenacious sputum by rendering it more fluid. Others, of which opiates may be considered typical, dry up the secretions. A third class, which may be called antiseptic, by altering the character of the secretions, converts a fœtid sputum into one less septic. Creosote and terebene, administered by inhalation or through the stomach, are substances of this type.

Expectoration, the term used to indicate both the sputum, *i.e.*, secretion, including mucus, ejected from air passages of head and chest, and the act of expectoration itself. In some instances, coughing and the accompanying expectoration of mucus is desirable, to rid the system of this substance. When a patient is known or suspected to have a communicable disease—such as tuberculosis, influenza, or pneumonia (qq.v.), care should be taken to collect the sputum in an appropriate container, and to keep it moist until it can be disposed of, and then burn it, or destroy it by means of disinfectants. In the case of diseases of the chest, examination of the sputum is sometimes of assistance in diagnosing the disease, its odor, color, and weight in water, being taken into consideration. The use of the microscope, and of certain dyes, or stains, to which various bacilli react, is also important in determining the morbid significance of the expectoration. See BACTERIA; SALIVA.

Expeditionary Force, a body of troops sent from its home base for operation in a foreign country. In the British army the term is used to denote the force of all arms dispatched for active operations in frontier wars—*e.g.*, Burma Expeditionary Force, Dongola Expeditionary Force; it is also applied in various army reorganization schemes to a force ready to be detailed for service on outbreak of war—*e.g.*, Expeditionary Force sent to South Africa in 1899; the one sent to France in August, 1914; and the one sent to France in September, 1939. The British and French sent an expeditionary force to Norway on April 15, 1940, after that nation had been invaded by Germany. With the invasion of the Netherlands and Belgium on May 10, 1940, Britain sent her expeditionary force into Flanders. Australia, New Zealand, and Canada sent expeditionary forces to the aid of England in 1940.

Expenditures, National. The national expenditure of a country is a significant reflection of its wealth and prosperity, its economic policies, and the general enlightenment and welfare of its citizens. In the past few decades in all of the more important countries of the world these expenditures have undergone revo-

lutionary changes in both character and amount.

The spectacular increase in the amount of expenditure is suggested by the tabulations below. This increase has been brought about (a) by increasing population; (b) by the World War; (c) by a long period of rising price levels; (d) by the increasing urbanization of population, which imposes additional burdens even on the national government; (e) by the modern revolution in forms of transportation, which has brought about a situation similar to the earlier period of railroad and canal building; (f) by generally rising standards of living, which require a higher quality of service on the part of government; (g) and by the increasing socialization of life in general. Approximately 16 per cent. of the total income of the people of the United States is now spent through governmental agencies; *i.e.*, in the form of public expenditures. Approximately 5 per cent. of total income is spent through the agency of the national government.

But more significant than the increase in amount are the changes in objects of expenditure. In contrast with earlier periods, when national expenditure was concerned almost entirely with military operations either for purposes of defence or of conquest, a large portion of national expenditure is now devoted to the promotion of agriculture, commerce and industry, the development and conservation of natural resources, and the promotion of education, health, and general welfare. It should not be overlooked, however, that the cost of wars, past and present, still makes up the larger portion of national expenditure for most of the countries of the world—amounting even in the United States, in 1940, to two-thirds of the total expenditure of the Federal Government.

European Countries.—Comparisons of the national expenditure of different countries must be made with caution on account of the varying distribution of governmental services among central and local governments.

Value in Millions of Dollars

Country	1914	1919	1940
United States	$ 735	$18,952	$9,681
Great Britain	957	10,728	10,187
Italy	510	2,921	1,745
France	1,912	5,963	1,598
Germany	1,423	1,456	.....
Russia	1,492	.....	30,980

Changes in total expenditure over a period of years are more instructive. The table shown in the preceding column shows the value in millions of dollars of the total national expenditure of the United States and the chief European countries, for 1914, 1919, and 1940, converted into dollars at the current rates of exchange for the different years.

United States.—The following table shows the total net ordinary expenditures of the United States during the past and present century:

1800–	$ 10,786,075	1925–	$2,930,707,176
1830–	15,143,066	1926–	3,517,763,213
1860–	63,130,598	1927–	3,416,699,268
1865–	1,297,555,224	1928–	3,437,348,021
1870–	309,653,561	1929–	3,848,463,190
1900–	520,860,847	1930–	3,994,152,487
1910–	693,617,065	1931–	4,091,597,712
1913–	724,511,963	1932–	5,153,644,895
1917–	2,086,042,104	1933–	5,142,953,627
1918–	13,791,907,895	1934–	7,105,050,085
1919–	18,952,141,180	1935–	7,375,825,166
1920–	6,141,745,240	1936–	8,879,798,258
1921–	4,891,275,319	1937–	8,105,158,547
1922–	3,618,037,797	1938–	7,691,287,108
1923–	3,647,674,783	1939–	9,268,338,030
1924–	3,404,295,127	1940–	9,681,233,540

Developments since 1920.—A number of significant developments have characterized the expenditures of the Federal Government in the United States, since 1920.

(1) *The Establishment of the Budget System.* The Budget and Accounting Act of 1921 created a Budget Bureau, in charge of a Director of the Budget, to be appointed by the President and responsible to him. This act, together with a voluntary reorganization of the committee system in the Senate and House, resulted in the inauguration of what is virtually an executive budget, submitted to Congress annually, and embracing a substantial portion of the total Federal expenditure.

(2) *Payment of the National Debt.* The Federal Government has adhered to the policy of retiring the public debt at the rate of more than $500,000,000 each year. However, in spite of this policy the national debt has continued to rise since 1932, amounting to $43,222,346,052 in 1940. This was partly caused by the creation of many new governmental agencies.

(3) *A Policy of Federal Aid to the States.* In recent years the Government has embarked upon a policy of extensive Federal aid to the States. The chief purposes for which such subventions have been made include highways, forestry conservation, agricultural development, vocational education, and provision for maternity and infancy hygiene. Subventions for highways amounted in 1940 to $204,516,000, in contrast with $150,000 in 1913. The policy of Federal aid has been criticized as an unwarranted encroachment upon the field of State and local government. It has been defended on the ground that it raises local standards of efficiency, brings about some degree of uniformity, and equalizes to some extent the tax burdens of different sections of the country.

(4) *A Conspicuous Increase in Expenditures for Purposes of Social Welfare.* These include the expenditures for old age pensions and social security; care of the unemployed through the Works Progress Administration and Public Works Administration; expenditures for education and the public health service; and numerous activities carried on by the departments of agriculture, commerce, and labor for the purpose of promoting the general social welfare.

The table on the next page indicates the general distribution of Federal expenditures at the present time (1940) and suggests some striking contrasts with the distribution of expenditures before the World War.

See DEBT, PUBLIC; FINANCE, PUBLIC.

Consult Ford's *Cost of Our National Government;* Seligman's *Studies in Public Finance;* Guest's *Public Expenditure;* Willoughby's *The National Budget System;* the National Industrial Conference Board's *Cost of Government in the United States.*

Expenses of a lawsuit are technically called costs in American and English law. See COSTS.

Experience is one of the most ambiguous words in the vocabulary of philosophy. When the term is used in what may be called a historical sense, as when we speak of 'learning from experience,' it refers to the past process by which our present knowledge was acquired, and emphasizes especially the direct contact with facts which gives the element of reality in knowledge, and makes it more than abstract notions communicated to us by others. When this usage of the term is extended to embrace the present and the future, we get the conception of experience as the continuous process by which the knowledge of any individual, especially as depending on his own direct contact with reality, grows and widens. And when, finally, we substitute the race for the individual, we have the widest conception of a collective experience embracing the whole life of the race and the knowledge acquired by living it. Other meanings in which the term experience is used may be regarded as more or less legitimate abstractions from this comprehensive and concrete meaning.

The distinction sometimes drawn between what is directly perceived and what is inferred suggests the reduction of primary or immediate experience to the barest minimum of sensation and feeling, while all the remainder of experience is explained as manufactured out of these primary sense data by processes of association and inference. And the further suggestion is apt to present itself that the primary sensations constitute the genuine reality of experience, while the superstructure is the less authentic work of the mind. It is when experience is broken up in this abstract way that the controversy arises between a spurious empiricism and the rationalism which is its counterpart. For actual experience, whether it be wide or narrow, is always concrete knowledge, and never mere data. And the work of the mind by which knowledge grows is never a work of arbitrary invention, but rather of discovery, so that the results are as real as what is directly given, and the distinction between the two cannot be drawn. See EMPIRICISM; RATIONALISM.

Experience Meeting, a religious meeting at which some of those present give testimony of their religious experiences. Meetings of this character are common among Methodists, by whom they are also known as Class Meetings.

Experience Table of Mortality. See INSURANCE, LIFE.

Experiment is distinguished from mere observation by the fact that the observer, instead of merely waiting for favorable conditions (as, for example, the astronomer must do), himself arranges the conditions of the phenomenon to be observed. A single experiment may become the 'crucial' test which decides once for all between two rival theories. Experiment is thus dictated by theory, and in turn aids theory far more directly than mere observation can do. Consequently, sciences in which experiment can be employed advance much more rapidly and securely than those which are dependent upon mere observation. A long course of observation may supply in some measure the place of experiment, because the many natural variations of conditions and circumstances may serve indirectly the same purpose as experiment secures directly—*viz.*, to show what are merely accidental circumstances and what really essential conditions.

Federal Expenditures

	1913	1940
General		
Legislative establishment	$ 13,291,813.52	$ 22,715,643.00
Executive proper	592,014.73	2,800,405.00
State Department	4,978,380.09	19,711,840.00
Treasury Department	62,113,949.60	339,066,633.05
War Department	162,607,912.09	707,852,838.00
Navy Department	134,092,416.93	720,789,461.00
Department of Justice	10,423,632.19	37,494,620.00
Post Office Department	2,169,340.97	784,550,000.00
Interior Department	42,689,915.60	78,181,130.65
Department of Agriculture	20,469,027.70	1,274,117,567.11
Department of Commerce	11,263,457.08	38,127,499.00
Department of Labor	3,347,380.11	28,668,880.00
U. S. Veterans' Bureau		557,078,000.00
Other Independent Offices and Commissions	2,878,325.95	1,710,094,027.00
District of Columbia	12,841,210.79	6,000,000.00
Total	$483,757,777.35	$6,327,548,543.81
Interest on Public Debt	$ 22,899,108.08	$1,050,000,000.00
Pensions	175,085,450.29	
Postal Deficiency	1,027,368.79	39,019,964.00
Panama Canal	41,741,258.03	24,774,924.00
Shipping Board		100,000,000.00
Judiciary		12,305,600.00
General Public Works Program		751,715,508.00
Investment of trust funds		791,054,000.00
Total ordinary expenditures	$724,511,962.54	$2,768,869,996.00
Public debt retirements chargeable against ordinary receipts	$ 24,191,610.50	$ 584,815,000.00
Total expenditures chargeable against ordinary receipts	$748,703,573.04	$9,681,233,539.81

Expert, a man of special practical experience or education in regard to a particular subject. An ***Expert Witness*** is a medical or scientific witness in a court of justice, selected on account of special qualifications. See EVIDENCE.

Exploits River, river, Newfoundland, rising in the southwestern part of the island and falling into Exploits Bay on the northeast coast. It is about 150 miles long, and navigable for 12 miles by steamers. It drains Red Indian Lake.

Explora'tion, a term meaning the search for new and undiscovered land. The discovery of new lands or of new geographic features dates from remote ages. As early as 604 B.C. Pharaoh-Necho, a Phœnician, went on an extensive expedition (three years) which took him down the Arabian Gulf, around the most southerly extremity of Africa into the Strait of Gibraltar, thence to the Mediterranean, and on to Egypt. The historian Herodotus describes this early voyage of discovery. In 570 A.D. Hanno (q.v.), the Carthaginian, traversed the West African coast on a journey of exploration. The Northmen, or Norsemen (q.v.), always wanderers and adventurers, discovered Iceland in 861 A.D. Marco Polo (q.v.), a Venetian, born in 1254, was the greatest traveller of his time, his travels extending over a period of twenty-six years and covering thousands of miles.

The discovery of America in 1492 by Christopher Columbus (q.v.) marks an epoch in the annals of exploration. Shortly after this the name of Vasco da Gama (q.v.), a Portuguese, became famous by reason of his commanding the sea expedition to India, *via* the Cape of Good Hope (1497), under the orders of King Emmanuel. John and Sebastian Cabot (qq.v.) also figure in this period. Magellan (q.v.) in his daring and protracted voyage (1520–21) discovered the Westward Passage and made possible the way around the world, although he himself fell at the hands of hostile Indians, in the port of Sebri, before his vessels completed their trip. In the reign of Queen Elizabeth Sir Walter Raleigh (q.v.) was most active in his efforts to colonize the new lands across the waters. In 1585 he sent out a colony of 108 settlers in seven ships, and in 1587 a second colony of 150 householders, and it was largely through his persistent efforts that England established herself in the New World. In 1595 Raleigh himself voyaged to Guiana and back. In the same century Sir Hugh Willoughby (q.v.) perished in an attempt to discover a northeast passage to Cathay (China) and India, and William Barentz met death on his third voyage (1596), at Icy Cape, Alaska. Henry (Hendrik) Hudson (q.v.), in search of the Northwest Passage (q.v.), in 1609 discovered the river which now bears his name, and on the voyage following (his fourth) he navigated Hudson Strait and sailed several hundred miles on Hudson Bay. It was not until

the Franklin expedition (1847) that the Northwest Passage, the search for which had cost a heavy toll in lives, vessels, and money, was finally discovered.

In the United States, Capt. Robert Gray (q.v.) discovered the Columbia River (1792), and was the first man to circumnavigate the world under the American flag. The Lewis and Clark expedition (see LEWIS, MERIWETHER; CLARK, WILLIAM) to the mouth of the Columbia River (1805–6), and John C. Frémont's travels (see FRÉMONT, J. C.) through the West to the Pacific Coast (1842–6), are prominent among nineteenth century explorations. In 1838, Lieut. Charles Wilkes (q.v.), of the U. S. Navy, with six moderate-sized vessels, set sail from Hampton Roads, Va., on a voyage of exploration in the southern seas. About one year later, he and his party discovered an antarctic continent. One of the vessels was lost at the mouth of the Columbia River. Lieut. Wilkes' flagship returned to New York nearly four years later.

In 1872 a voyage of research was made by the British steamship, *Challenger*, for the purpose of examining ocean basins and ocean currents, mapping the basins, and determining the physical and biological conditions of the Atlantic, the Southern and the Pacific Oceans (see CHALLENGER EXPEDITION).

For African exploration see AFRICA, *Exploration;* for Polar explorations, ARCTIC EXPLORATION and ANTARTIC EXPLORATION.

Exploration, Polar. See ARCTIC EXPLORATION; ANTARCTIC EXPLORATION.

Explosion. See EXPLOSIVES.

Explosions. See MINING.

Explo'sives, substances which may be made to change their condition in a manner to generate force quickly through the evolution of gases whose volume is many times greater than that of the original substance. Explosives may be solid, liquid, or gaseous, but only those of solid form are widely used; and they may be chemical compounds or mechanical mixtures. By far the greater number of explosives, as prepared for practical use, are mixtures, as few pure compounds possess all the desirable qualifications. A considerable number of substances, not ordinarily regarded as explosives, possess the necessary requirements under certain conditions—such, for instance, are mill dust, hydrocarbon gases, vapors of hydrocarbons that are ordinarily liquid; while all gases under pressure act with destructive violence if the container gives way.

Explosion is a relative term, and applies to the rate at which the substance changes its condition. If this rate is slow, the process is called combustion, chemical reaction, oxidation, vaporization or expansion; if sufficiently rapid to cause injury or destruction to surrounding objects, it is called explosion. Explosions in which the change occurs simultaneously throughout the mass, so that the whole volume of gas is released at practically the same instant, are called detonations. Some explosive substances cannot be perfectly detonated; others are detonated only with great difficulty. Some are so sensitive that any shock, or combustion of a part, detonates the whole mass present; others, still, can only be made to detonate if the right sort of primer or detonator is employed. Thus wet *guncotton*, which is one of the safest of all explosives to handle, is readily detonated by a primer consisting of *fulminate of mercury* cap and a small quantity of dry *guncotton*.

Explosives are fired by means of heat, flame, chemical action, or shock. Some can be detonated by any of these means, some only by shock. If disruptive or destructive effect is desired, it is manifest that detonation is desirable. If propulsive effort only is wanted, a slower rate of evolution of the gas is necessary. Experiments have shown that the safer of the more powerful explosives are more fully and satisfactorily detonated by means of certain kinds of shock, and that the shock given by the explosion of a primer of *fulminate of mercury* is in most cases likely to give better results than any other means. The fulminate primer is easily exploded by percussion, friction, or electricity. The fact that different shocks of the same apparent intensity give very different results leads to the belief that the disruption of the bonds which hold the atoms in the molecules of explosives is affected more readily by certain varieties of waves of shock than by others.

The total force of an explosion depends upon the volume of gas formed, the amount of heat evolved, and the rapidity of formation—the rapidity giving a dynamic effect and the temperature assisting to expand the gas volume. The amount of heat evolved is of great importance, and in some cases increases many times the volume of gas formed. The character of the destructive effect of explosions varies with the rapidity of the evolution of the gas, the amount of gas, and its pressure when it comes in contact with the material destroyed. Violent (quick detonating) explosives cause great destruction within narrow limits, if the volume of gas be large. Less violent explosives frequently give a wider range of destruction, but the work done is less intensive. The more violent an explosive the less it needs to be contained, tamped, or backed up. If *chloride of nitrogen* be exploded on a piece of rock it will cause about as much damage to the rock as if a heavy casting were placed over it. *Black gunpowder*, if unconfined, would cause no injury to the rock.

The division of explosives into definite classes is impossible unless the classes are very numerous. The term 'high explosive' is a relative one. As generally used, it means an explosive much stronger than gunpowder. It is also used to designate an explosive which can be *detonated—i.e.*, one which explodes violently regardless of the volume of gas produced. With regard to their use, explosives may be divided into (*a*) *blasting, rending,* or *disruptive explosives* and (*b*) *propellants*. By far the larger number are suitable only for the first-mentioned use. Explosives may be either pure *chemical compounds* or *mechanical mixtures*. Nearly all the compounds contain nitrogen in some form; a few contain metallic chlorates, perchlorates, permanganates, and chromates.

Explosive Compounds.—A common classification of explosive compounds is as follows:

1. Nitro-substitution compounds.
2. Other nitrogen compounds.
3. Chlorates, permanganates, etc.

Nitro-substitution compounds are formed from various hydrocarbons by the action of *nitric acid* or other means. One or more atoms of hydrogen are displaced by the same number of groups of atoms, forming the univalent radicle nitryl (NO_2), consisting of one atom of nitrogen and two of oxygen. Both *nitro-glycerin* (q.v.) and *nitrocellulose* (q.v.; see also GUNCOTTON) were formerly regarded as belonging to this class, but this is now disputed. In the case of nitro-glycerin there is reasonable proof that it is a trinitrate of glyceryl (a radicle forming part of the glycerin molecule), but as to guncotton and the other nitrocelluloses the evidence is less convincing, owing to certain chemical uncertainties; the nitrocelluloses are, however, now quite generally regarded as nitrates. Among the important members of this nitro group are: *picric acid* or *trinitrophenol*, $C_6H_2{-}OH{-}(N_2O_3)$; *trinitrotoluene*, $C_6H_2{-}CH_3$

Explosives

$-(NO_2)_3$; *nitrobenzene*, $C_6H_5NO_2$; *dinitrobenzene*, $C_6H_4(NO_2)_2$; *nitronaphthal*, $C_{10}H_6-OH-NO_2$; and many others of less importance. *Picric acid* (q.v.) is obtained by the action of nitric and sulphuric acid upon phenol (carbolic acid), and also directly from various organic substances. It is largely used as a bursting charge of shells for heavy guns, either alone or mixed with other ingredients. *Lyddite, Melinite, Maximite*, etc., are chiefly composed of picric acid. Picric acid forms salts with various metals; of these, *barium pictrate* and *ammonium pictrate* are powerful explosives, and are extensively used in explosive mixtures.

By the action of nitrous acid at low temperatures on aromatic amines *diazo compounds* are produced. Many of these contain no oxygen, but are nevertheless violently explosive.

There are a number of important nitrogen compounds belonging to diverse groups. *Mercuric fulminate*, $HgC_2N_2O_2$, plays a most important part in the operation of explosives. It is particularly sensitive to friction and percussion; and, as already stated, the character of its explosion is such as to cause it to act as a most efficient detonator of other explosives, or to furnish sufficient flame to ignite explosives which are not desired to be detonated. In the latter case it is usually mixed with more or less inert but inflammable powders. An interesting explosive which contains no oxygen is *azoimide* or *hydrazoic acid*, HN_3. The ammonium salt, NH_4N_3, is also a most powerful explosive.

The third class of compounds comprises the chlorites, perchlorates, permanganates, chromates, and a few others of miscellaneous kinds and little importance. Most of the members of this group are of feeble strength when used alone, but when combined with other substances form useful explosive mixtures.

Explosive Mixtures are exceedingly numerous and diverse in character. Like explosives in general, they may be divided into *blasting agents* and *propellants*, but some belong to both groups. Of the former, the most important are *dynamite* (q.v.) and *black gunpowder* (see GUNPOWDER); of the latter, *black* and *smokeless gunpowders*. *Dynamite* is a mixture of nitroglycerin with some solid, principally to obviate the necessity of using a liquid. *Black gunpowder* is no longer used in military or naval arms of any sort, except by imperfectly civilized races, and it is but little used in sporting and hunting guns. It is still employed for blasting purposes in large quantities. This name is therefore no longer justified by its use, and it is now usually known as *black powder*. *Brown gunpowder* (see GUNPOWDER), which displaced black powder in heavy guns for a few years, soon gave way to the smokeless types (see GUNPOWDER). *Smokeless gunpowders* are chiefly composed of nitrocellulose (see GUNCOTTON) and a small amount of some substance acting as a stabilizer, or of nitrocellulose mixed with nitroglycerin or with other substances. In all cases the mixture is colloided and shaped into grains, strips, cords, flakes, and the like.

Explosive mixtures of which various nitrates are the principal ingredients include *black powder; amide powder* (ammonium and potassium nitrates and charcoal); *azotine* (sodium nitrate 69.04, carbon 15.23, *sulphane* 11.43, petroleum 4.29); *petralite* (potassium nitrate 64, impregnated wood or charcoal 30, crude antimony 6); *joveite* (sodium nitrate 64 to 76; nitronaphthalene 6 to 8, nitrophenol 16 to 30).

Explosive mixtures of the chlorate class are numerous and many are in common use for blasting purposes. Like *potassium chlorate* itself, most of the mixtures containing it are sensitive to shock, friction, moderate heat, and the action of acids, particularly sulphuric acid. Others have a sufficient amount of inert substances to render the whole mass insensitive to any shock likely to be caused by ordinary handling. All the chlorate explosives are easily detonated with a suitable primer. The gases evolved by the chlorate mixtures, especially those containing only chlorates and the hydrocarbons, are less poisonous and irritating to the lungs than the gases from nitrates, sulphides, picric acid, nitrocellulose, and nitroglycerin, which are largely composed of nitrogen, oxides of nitrogen, carbon monoxide and carbon dioxide. Mixtures of *potassium chlorate* with sulphur, certain sulphides, or phosphorus form compositions that are very sensitive to friction or percussion and are used to some extent in primers. *Potassium* and *sodium perchlorates, permanganates*, and *bichromates* give mixtures similar in character to those of the chlorates, but they are somewhat less sensitive and the bichromates are less powerful.

Mixtures consisting chiefly or largely of picric acid, the picrates, or nitrohydrocarbons are very numerous. The best known of these mixtures are: *bellite* (ammonium nitrate 5 parts and metadinitrobenzene 1 part, melted together and potassium nitrate stirred into the mixture); *extralite* (ammonium nitrate, potassium chlorate, and naphthalene); *joveite* (varying proportions of nitronaphthalene, 6 to 8, nitrophenol, 16 to 30, and sodium nitrate, 64 to 76); *roburnite* (ammonium nitrate and carefully purified chlorinated dinitrobenzene); *securite* (also ammonium nitrate and dinitrobenzene; ammonal ammonium nitrate and trinitrotolnol, or T.N.T.). The latter, as well as T.N.T alone, was extensively used in high-explosive shells during the Great War. Many of these explosives are of the Sprengel type.

In 1873, Dr. Herman Sprengel first called attention to a class of explosives consisting of two inexplosive or feebly explosive substances which, when mixed together, will yield an explosive capable of violent detonation. Some of these may be prepared in advance, and are only made to explode by a suitable detonator; others are combined only when about to be used. Some of the commonest explosives of this type are *rackarock*, the *ammonites, bellite, roburite, securite, hellofite*, and *panclastite*.

In addition to their employment as propellants in heavy guns and small arms, explosives are employed in the naval and military services for the explosive charges of mines and torpedoes and for the bursting charges of shells. For mines and torpedoes high nitrated *nitrocellulose* or *guncotton* (q.v.) is found to be most satisfactory. For the bursting charges of common shell, especially of the smaller calibres, *black powder* is much used; for heavy shell and for armor-piercing shell of all calibres, mixtures containing *picric acid* or the picrates (such as *lyddite, melinite, maximite*, etc.) have given the best results. *Ecrasite* (trinitrocresol) is used in Austria in place of picric acid (trinitrophenol).

The danger of careless manufacture and handling of explosives is very serious, and has become more and more appreciated as the manufacture, transportation, and use has increased. In 1860 the British government passed a law which was the first to provide minute and stringent regulations on the subject. This was followed by the Explosives Act of 1875, which still further broadened the scope of control. Nearly all countries in the world now have similar acts. In the United States the statutes of the different States provide for the control of the operations.

In the United States in 1937 there were 77 establishments producing explosives, with 5,406 workers, and products to the value of $58,181,337. After the passage of the National Defense Act of 1940 the manufacture of explosives rose to new peacetime heights.

Historical.—No doubt the ancients noticed that certain substances were explosive, but it does not appear that any important use was made of this knowledge. The most celebrated of the early incendiary mixtures is *Greek fire* (q.v.), which seems to have been known in the seventh century. Its composition is variously given. In a description attributed to Albertus Magnus (about 1240 A.D.), it is said to consist of sulphur, salt, Persian gum, pitch, and oil. Other sources say sulphur, crude petroleum or naphtha, crude saltpetre, pitch, and other substances. Such a mixture is evidently explosive, and quite probably it eventually developed into gunpowder, which is first heard of in the thirteenth century. Black gunpowder remained the only explosive of importance until the middle of the nineteenth century. In 1845, Schönbein discovered the explosive nature of guncotton; in 1847, Sobrero discovered nitroglycerin; and in 1866 Nobel invented dynamite. Since then a considerable variety of explosive mixtures have been devised for a wide range of uses. The first smokeless gunpowders were made between 1860 and 1870, but they lacked keeping qualities and uniformity of performance, which were finally obtained in a guncotton powder devised by M. Vieille in 1886.

See DYNAMITE; NITROGLYCERIN.

Consult Guttmann's *Manufacture of Explosives;* Bernadou's *Smokeless Powders;* Weaver's *Notes on Military Explosives* (3d ed. 1912); Brunswig's *Explosives* (Eng. trans. 1912); Marshall's *Explosives* (1917).

Exponents, in mathematics. See INDEX.

Export-Import Bank of Washington. An agency of the Federal Government incorporated under the laws of the District of Columbia pursuant to an act of Congress of June 1936, and later put under the direction of the Federal Loan Agency. The purpose of the bank was to facilitate and aid in financing exports, imports, and the exchange of commodities between the United States and its Territories and foreign countries. The Bank was authorized to do a general banking business including the purchase of notes and securities, the making of loans, and the lending of money, but not to purchase outright foreign securities or blocked balances having no relation to actual current commercial transactions. It was interested primarily in assisting nationals of this country in the development of sound foreign trade, and extended credit to importers and exporters. Capital stock of the Bank was $46,000,000, increased by $100,000,000 in March 1940. The Bank was made an instrument of national policy in giving loans to Finland in March 1940.

Exports and Imports.—*Exports,* to give the term its most common meaning and speaking from the standpoint of a given country, are commodities, including gold and silver, sent outward across that country's borders to other parts of the world. *Imports,* defined from the same standpoint, are commodities, including gold and silver, coming inward across the country's borders from other countries. There is a growing tendency to call the outward and inward movements of commodities and precious metals 'visible exports and imports' and to recognize the existence of 'invisible exports and imports' (*i.e.,* invisible because they do not pass through governmental customs houses) that take such shapes as stocks and bonds and services rendered by people of one country to people of another. Thus an insurance policy issued by a British insurance company to an American firm would be an invisible import into the United States of protection against loss; while an investigation made by an American firm of consulting engineers for a British company would be an invisible export of technical services.

The volume of goods visibly exchanged every year between the countries of the world is very great, as shown by the following figures compiled by the United States Department of Commerce:

Visible Exports and Imports (in Millions of Dollars) of Leading Countries in 1938 (excluding gold and silver)

	EXPORTS TOTAL	IMPORT TOTAL	EXPORTS, DOLLARS, PER CAPITA	IMPORTS, DOLLARS PER CAPITA
United States	3,057	1,960	23.5	15.1
United Kingdom	2,302	4,196	48.5	88.4
Canada (1938-9)	970	658	86.6	58.8
Germany	2,111	2,188	27.1	28.1
France	881	1,324	21.0	31.5
Italy	552	593	12.6	13.5
Japan	765	758	10.6	10.5
World (127 countries; Spain omitted)		24,096		

*NOTE: Export figures not given to avoid double counting, since, for the world as a whole, the flow of trade may be measured either as it leaves the various countries or as it enters them, but not both. Value of total imports is given above because imports are valued at market prices in receiving country plus shipping expenses, while exports are valued in home markets before shipment. Import values are thus more inclusive.

Further evidence of the extent to which goods are exchanged over international boundary lines is the fact that, in recent years, the proportions of total world production of certain basic commodities that entered into foreign trade were approximately as follows: wheat, 20 per cent.; rice, 10 per cent.; sugar, 50 per cent.; cotton, 50 per cent.; wool, 67 per cent; and rubber, nearly 100 per cent.

The volume of invisible exports and imports is likewise very large, but from its very nature its amount can only be estimated and knowledge concerning it is incomplete.

In order to get a clear picture of the chief cause for the exchange of goods and services between countries, it is only necessary to remember that, even within the United States, various sections tend to specialize in their economic pursuits. Food is provided principally by certain areas; coal, iron, petroleum and other minerals, chiefly by other sections; and cotton and forest products by still others. Manufacturing is done mainly in the cities and pleasure resorts are found mostly in the mountains, on lakes and on the seacoasts. Between these different sections flows a continuous stream of commerce. Similarly, each of the countries of the world can produce certain commodities and services with relatively greater ease than other countries. The ability of a country to produce any given commodity, however, is relatively, not absolutely, measured. For example, the United States might be able to produce both rubber and automobiles cheaper than the East Indies, but if rubber were produced only slightly cheaper in the United States than in the East Indies, while automobiles were produced at very much less cost, the United States would forego its slight advantage in the production of rubber in order to make the most of its greater advantage in the production of automobiles. As a result, the East Indies would devote themselves to the production of rubber, the United States to the production of automobiles, and an exchange of automobiles for rubber would occur between them. This is in accordance with what is known as the

Exports and Imports

principle of comparative costs and presupposes no tariff restrictions or other barriers to the free flow of trade across international boundaries.

Most of the countries of Western Europe are great workshops, which are unable to produce within their borders all the food they eat and all the raw materials they use in turning out their manufactured products. Some countries of Eastern Europe, on the contrary, are great granaries and sources of raw materials and are unable to produce the manufactured products they require. A natural trade thus arises wherein Western Europe buys food and raw material from Eastern Europe and pays for them with manufactured articles.

World trade is thus fundamentally an exchange of foods, raw materials and manufactured products between the countries of the world, each of which uses the articles that are easily produced within its borders to purchase necessary and desirable things, not obtainable within its borders, from other parts of the world.

Factors Determining the Type of Things a Country Exports and Imports.—The natural resources, the human resources and the stage of economic development of a country determine the nature of the things it exports and imports. Clearly, its climate and its soil and the gifts of nature existing under the soil or in surrounding waters chiefly determine the things which it will be possible to extract from the earth. It should be remembered, however, that the value of the natural resources is in direct relation to the enlightenment of the people, in direct relation, that is, to the country's human resources. For example, the extensive petroleum deposits of the United States would have been of little value to the dwellers in that area a hundred years ago or more, because even if the inhabitants had been fully aware of the existence of the petroleum, they would not have known how to use it; but now that science has developed and perfected the internal combustion engine, these deposits are of priceless value to the nation.

The proportion of the world's total supply of a given resource that lies within a country is also important in determining the character of that country's exports. The nearer the country comes to having a monopoly of the supply, the greater will be the proportion of the world's demand for the article directed to the country in question, the greater will be the exports of it and the larger its part in the value of total exports.

The human resources of a country, that is, the number of its inhabitants, their character, education and training, also exercise a great influence over the nature of its exports. The people of the United States, working vast and varied natural resources with a scanty labor supply, have characterized their labors by the most extensive substitution of mechanical energy for human toil the world has yet seen. The peoples of Europe and Asia, generally speaking, each working with their own less ample and less varied natural resources and with more ample labor, have tended to specialize in handmade articles possessing individuality rather than standardization and embodying artistic values growing out of their older cultures.

The proportions of total exports and imports that are composed of food, raw materials, finished manufactures and invisible items, are largely determined by the stage that the country has attained in economic development. The typical course of the economic development of a modern industrialized nation is marked by several stages. First, the population, small in number and living mostly a rural life, produces chiefly foods and raw materials and a few finished manufactures; large surpluses of foods and materials together with important amounts of securities (*i.e.*, stocks, bonds, real estate deeds and mortgages) are exported to pay for the imports of manufactures. Second, there is an intermediate stage in which relatively fewer people living in rural districts produce food required by themselves and by the relatively greater number of people living in the rapidly growing cities; while the growing industrial centres turn out a larger proportion of the finished manufactures needed by the country. The results are that, in terms of percentages, fewer materials are exported in the raw state and more in the manufactured state and more raw materials and fewer finished manufactures are imported. During this stage, exports of securities become smaller in proportion to total exports while a small stream of security imports sets in. A third stage finds a denser population which is still more concentrated than before in urban centres. Exports of food form a still smaller proportion of all exports, while imports of food, depending upon the increase in the density of population and in the degree to which urbanization has been carried, become relatively still more prominent. The output of finished manufactures by the industrial centres is greater than the home market requires so that finished products come to be the leading type of export and a more minor type of import; at the same time the high stage of industrial development increases the home consumption of raw materials so that fewer are exported and more are imported and in amounts sufficient to make them the leading type of import. Finally, exports of securities continue but are greatly overbalanced by security imports which come to form an important share of total imports. Thus natural resources, human resources and the stage of economic development all combine to determine the type of things a country sends out and brings in over its borders.

It should be noted that there is a limit to which an independent country can export securities of which some represent debts payable by its governing bodies and by its industries, and others represent ownership of its land and other property. If such exports were carried to an extreme, the property and income of the country either would belong no longer to its people but to foreigners, or would be so heavily mortgaged to foreign lenders as to make it impossible for the country to pay off the mortgages. Since the preservation of national sovereignty limits too extreme an export of securities, it is clear that, in the long run, most of the goods and services a country imports, and most of its indebtedness to foreigners from any other origin, must be paid for by the exportation of other goods and services. This is the reason why the question of the payment of war debts and reparations arising out of the Great War is such an important and thorny one. The only way in which extensive payments can be made to the creditor countries is in the shape of goods and services. The import of large amounts of goods and services into the creditor countries, however, would be detrimental to their own industries that produce similar things; so naturally those interested in the threatened industries have demanded tariffs and other means of protection against the inflow of competitive goods and services, and their demands have in various degrees been met. The situation is substantially one in which the creditor countries exact payment from the debtor countries and then attempt to keep out the goods and services which are the debtors' chief means of payment,—obviously an impossible solution. If the sovereignty of the debtor countries is to be preserved, either the creditors must receive goods and services in settlement of the debts or the debts cannot be paid.

It should be recalled that the

Exports and Imports

general welfare of the people of a country depends in part upon necessary and desirable goods and services that can be obtained in quantity only from other countries, and that these things must therefore be imported if the well-being and comfort of that nation are to be maintained. Hence, the significance of imports. In order to pay for them, however, other goods and services must be exported. The significance of exports arises from the fact that they are the means of purchasing abroad the imports necessary to the country's well-being. To a marked extent, the countries of the world actually do tend to specialize in their respective economic pursuits and, as a result, their exports are likely to be much more specialized than their imports. As long as the preservation of international peace and security is so uncertain it would be dangerous to the national safety of a country to carry such specialization to the point where that country relied solely upon other countries for the full supplies of certain goods and services necessary to its existence. Since the Great War various countries have tried to acquire or to develop at home their own agriculture and vital industries, their own sources of supply of foods and materials, their own trained personnel necessary to render themselves more independent of others so far as their vital necessities are concerned.

The process by which a country exchanges its exports for imports consists mainly of the sale of its exportable surplus of goods in the international markets and of the use of the proceeds to buy the things it wishes to import. These international markets are highly competitive, however, and in order that the export industries of the country may hold their share of the world trade, they must be able to compete with those of foreign countries in the following respects: control of supplies, as extensive as possible, of raw materials,—the nearer to a monopoly, the better; cheapness in price, all shipping expenses and tariff duties included; pre-eminence in quality; ability to extend credit on favorable terms to buyers; government aid to exporters in the way of expert advice, collection of trade statistics, protection of property, laws facilitating exports, and even financial subsidy; and a knowledge of, and deference to, the language, laws, customs, traditions and manner of living of the foreign peoples with whom they deal.

Government Supervision over Exports and Imports.—Governmental supervision over exports is in general for the purpose of ensuring that no goods are exported contrary to public policy, especially in time of war, and of compiling foreign trade statistics. Governmental supervision over imports is undertaken for the purpose of raising revenue and for the purpose of protecting the well-being of the country's people and industries. Articles dangerous to public health and morals are excluded; in most countries, articles competing with the products of certain favored home industries are admitted only upon payment of import duties which are added to their selling prices in the home markets, raising them to points at which the imported goods enjoy no competitive advantage over domestic goods, the home industries thus being protected to a certain extent against foreign competition while at the same time the government derives some revenue.

United States.—In 1821, the United States exported relatively few finished manufactures but imported a great many; finished manufactures constituting 6 per cent. of the total exports and 57 per cent. of the total imports. The lapse of a century has brought a significant change, since, in 1939, finished manufactures had increased to 53 per cent. of the total exports but declined to 19 per cent. of the total imports.

The lapse of a century has also brought about significant changes in the geographic distribution of exports and imports. In 1821, Europe took 65 per cent. of all United States exports and sent 64 per cent. of all imports; about the middle of the century, Europe took as much as 83 per cent. of the exports and sent as much as 71 per cent. of the imports. Perhaps the most striking change is the rise to importance of Asia as a source of supply of the things the United States imports; while the relatively great increase of the share of imports coming from South America, Africa and Oceania is also clearly marked.

The foregoing facts throw into high relief the principal changes in export and import trade during this century. In 1821, the United States was in the first stage of economic development, *i.e.*, was exporting mainly food and materials and taking in return mainly finished manufactures and was trading, therefore, very largely with the countries of Europe and North America. The country in 1940 was in an advanced stage of economic development, its main class of exports was finished manufactures and its most important class of imports was crude materials to be worked up by home industries. Since 1875, with the exception of only two years, the visible exports from the United States have regularly surpassed the visible imports. Nevertheless at the outbreak of the Great War it was estimated that the United States was a debtor nation to the extent of five billion dollars; but the events of the War turned the country almost overnight from a debtor nation into a creditor nation. This was effected by a tremendous volume of exports, far in excess of imports, as may be seen from the preceding table, that rapidly paid off or offset its previous indebtedness to the world and made the United States a large creditor to its

Total Visible Exports, Imports and Excess of Exports of the United States (including gold and silver in millions of dollars)

Year	Total Exports	Total Imports	Excess of Exports
1876–1913—total	47,598	36,554	11,044
1914	2,388	1,873	515
1915	3,640	2,265	1,375
1916	5,709	3,110	2,599
1917	6,689	3,558	3,131
1918	6,443	3,165	3,278
Four war years—total			10,383
1919	8,528	4,070	4,457
1921	4,560	3,263	1,297
1923	4,268	4,189	79
1926	5,017	4,714	303
1927	5,142	4,447	695
1928	5,777	4,328	1,449
1934	2,139	1,655	484
1935	2,283	2,047	236
1936	2,456	2,423	33
1937	3,349	3,084	265
1938	3,094	1,960	1,134
1939	3,177	2,318	859

allies,—which is to say that the huge visible export balance was paid for by an invisible import of securities. In the decade following the war, however, the continued outpouring of exports created an excess of visible exports over imports even exceeding that of the war period.

During the war, American exports expanded faster than imports, but in the post-war decade, the tendency has been for imports to expand at a faster rate than exports. For the years 1919–1923 inclusive, visible imports were 69.3 per cent. of exports; for the years 1924–1928 inclusive, imports were 84.4 per cent. of exports. If this tendency of imports to increase faster than exports continues, it will result sooner or later in the cessation of export balances.

Several significant features stand out in the above figures for United States foreign trade. There was a great slump, primarily in farm products, after the first World War. American high tariffs kept foreign countries from selling their products here, and consequently from buying here. The reciprocal trade agreements policy after 1934 resulted in an increase of foreign commerce.

The five leading articles exported from the United States are raw cotton, petroleum and its products, machinery, automobiles, including parts and accessories, and aircraft. The chief customers of the United States in 1939 were Great Britain, Canada, Japan, France, and the Philippines. Industrial machinery was the export of greatest value. The five leading articles of import in 1939 were raw silk, crude rubber, coffee, cane sugar and paper, including paper manufactures.

Among the invisible exports and imports, securities, claims to interest and to dividends, and services to tourists are the most important in amount. However, transportation services, immigrant remittances, motion picture royalties, insurance protection, electric power, telegraph and cable services, use of patents and copyrights, and advertising services, are exchanged between nations in amounts running into hundreds of millions of dollars annually.

Bibliography.—For current export and import statistics, consult *Monthly Summary of Foreign Commerce of the United States; Statistical Abstract of the United States; Commerce Yearbook;* and numerous trade information bulletins,—all published by the United States Department of Commerce. For statistics of foreign countries for recent years see *Memorandum of International Trade and Balances of Payment'* published by the League of Nations. See also TRADE; PROTECTION, RECIPROCITY.

Expositions. See EXHIBITIONS.

Express Companies, originally companies organized to conduct a service for the expedited delivery of goods or money, performing functions in this respect additional to those performed by railroads, steamship lines and other common carriers. Today, the express services are conducted by the railroads themselves by means of an organization known as the Railway Express Agency, the individual companies which originally carried on the express business having either dissolved or changed in character.

Express service differs from railroad freight service particularly with respect to its much greater expedition, its complete pick-up and delivery functions and the parcel rather than bulk character of the greater part of the shipments. Express traffic, however, is of the widest variety. It includes money, securities, all varieties of commodities, race horses and a great volume of perishable freight requiring unusually prompt delivery. The bulk of the medium or long distance express traffic is carried in cars moving in fast passenger trains. Between many important business centres exclusively express service trains are operated, such trains moving on the equivalent of fast passenger schedules. Motor trucks, steamship lines and now the airplane are also extensively used.

The express system dates back to 1839 when William Harnden undertook to handle packages and documents between New York and Boston and to execute commissions for the merchants of the two cities. It is said that he started out with an understanding with the transportation companies and a carpet bag. Ready demand for the service soon made necessary the employment of messengers, several of whom later started in business on their own account in other sections of the country. In 1840, a competitor, Alvin Adams, commenced a similar New York-New England service, and in 1854, Adams & Co., Harnden & Co. and two other firms, Thompson & Co. and Kinsley & Co., consolidated their operations under the name Adams Express Company, which continued in the express business until June, 1918.

One of Harnden's agents was Henry Wells, who, in company with William G. Fargo, a banker, in 1845 organized the Wells Company, which, with the Livingston Company, organized in 1841, were, in 1850, consolidated to form the American Express Company. Like the Adams Company, it also retired from the express business in 1918. It continued, however, an extensive domestic and foreign money order, travelers' checks and tourist business which it had built up beginning in 1890, business having been considerably enlarged in 1918 by the taking over of a similar business which had been previously conducted by the Adams Express Company.

Wells and Fargo, after the organization of the American Express Company, carried their operations into California and the Far West. With the Pioneer Stage Company and similar interests, it was acquired by the Holladay Overland Mail and Express Company, continuing however under the name Wells Fargo & Company. This company provided a money and banking service for the gold miners of '49. It carried their mail across the plains in its stage coaches and not the least picturesque part of its carrier was the operation of the famous pony express. With the advent of the railroad it continued in service and ultimately extended its operations to the Atlantic seaboard.

Other important express companies include the United States Express Company; the National, later acquired by the American; the Southern, a subsidiary of the Adams; the Pacific Express Company, which was acquired by Wells Fargo; the Northern, which operated over the Northern Pacific R.R.; the Great Northern, which operated over the Great Northern R. R.; the Globe and the Western.

By 1914, the number of express companies had been reduced by consolidations to seven in number, namely: the Adams, American, Wells Fargo, Southern, Great Northern, Western and Northern. Of these, the first four operated over approximately 92 per cent. of the railroad mileage of the country and transacted approximately 95 per cent. of its express business. Each of the seven companies, speaking generally, tended to have a territory of its own; each company operated under contract with the individual railroads over the lines of which it conducted service. Usually, the railroad company gave the express company a monopoly of the express business over its line and provided free transportation for the express company's officers and employees and for express company property and supplies. For compensation, the express company, in most instances, paid the railroad company a percentage of the gross receipts from the traffic. The company assumed

Express Companies

all risk of loss or damage to property or persons and carried free of charge all money or packages pertaining to the business of the railroad.

The status of the express companies was radically changed in 1918 when the railroads were placed under Federal control as part of the government's war programme. William G. McAdoo, Director-General of railroads, refused to continue the contracts with the individual express companies, but gave notice that if the express companies would form a single corporation he would make a contract with the new corporation to conduct the express business as his agent. Accordingly, such a new corporation was created under the name American Railway Express Company.

In conformance with the desires of the Railroad Administration, a standard contract was entered into whereby the new company took over the express business upon the railroads as agent of the Director-General, an arrangement which continued until the railroads were returned to private control in 1920. At that time, the American Railway Express Company was continued in existence and henceforth conducted the express business under contract with all the individual railroads, with the exception of certain railroads in the Southeast which established a separate company operating over their lines and known as the Southeastern Express Company, which is still conducting business as the agent of these roads.

The new contracts between the American Railway Express Company and the railroads embodied rather elaborate provisions for the division of revenues. The railroads were grouped for this purpose by districts—Eastern, Southern, Western and Mountain-Pacific. It was provided that after deduction of expenses the balance remaining was to be distributed as follows: Two and one-half per cent. to the express companies and the remainder among the railroads in the group in the proportion that the gross express transportation revenues earned on each railroad for the month bore to the total gross express transportation revenues earned on all the railroads in the group. There was, in addition, a provision for the distribution of revenues which worked out as to yield to the railroads about one-half the total express receipts.

There was another important provision to the effect that the contracts should contine in force until February 28, 1929, at which date, if desired, the railroads might purchase from the express company, at cost less depreciation, all the property of the express company. When the time came to consider the matter, the railroads after lengthy discussion decided to take advantage of this provision of the contract, and organized a new company known as the Railway Express Agency, having 1,000 shares of capital stock to be sold to the participating railroads at $100 per share. The number of shares allotted to each railroad was determined by the ratio that the express business handled on each railroad, measured by the average receipts for the years 1923 to 1926, bore to the gross business handled in this period by all the railroads.

As provided in the contracts with the American Railway Express Company, the express properties of that company were taken over at their book value less depreciation, the purchase price proving to be $30,313,000. The funds were raised by means of a bond issue and upon their payment the American Railway Express Company retired from the express business after having been engaged in it for a 9-year period.

As in the case of its predecessor the Railway Express Agency also has an elaborate arrangement for the distribution of its net income. Each railroad has executed a 25-year operating agreement appointing the Express Agency as its exclusive agent for conducting all the express business on its line. The express agency may use motor-trucks, aircraft or transportation instrumentality other than railroad trains to carry property which would otherwise move by railroad, only with the consent of the railroads that would participate in such transportation if conducted by railroad. The railroad reserves the right to transport property by these other means of transportation if desired. The express agency agrees also to divide the competitive traffic upon a fair and equitable basis among the carriers. Railroads other than those holding the stock of the Express Agency are allowed to participate in the service—this provision being inserted to allow inclusion of the small or short-line railroads.

The important matter of the allocation of net revenues is covered in elaborate provisions patterned closely upon those covering this matter in the former contracts with the American Railway Express Company.

From an economic standpoint, one of the important phases of the establishment of the American Railway Express Company in 1920 was the elimination of duplication of effort as between several private companies performing a similar service. The creation of the Railway Express Agency in 1929 was a logical step in the same direction because it meant that the railroads themselves then took over a service they were believed well able themselves to perform without the intrusion of an outside agency. It is expected that the Railway Express Agency, acting for the railroads as a whole, will coördinate the elaborate express services while saving the costs of duplication of pick-up and delivery services.

The express companies were not subject to public regulation until they were placed under the regulation of the Interstate Commerce Commission in 1913. Congress, in April of that year, included in the Hepburn Law provisions: (1) that express companies shall file with the Interstate Commerce Commission a table of the rates charged by them, and that such rates be fixed subject to the approval of that Commission; (2) that these rates shall be the same for all, no discrimination being made; (3) that express companies collecting or delivering parcels or packages shall file a statement of the rates charged by them for these services separately from the statement of rates affecting railroad transportation; (4) that express companies shall supply their own cars for use on the railroads;(5) that any express company, employee, director, or officer thereof, found guilty of violating the regulations shall be punished by a fine of not more than $5.000, three years' imprisonment, or both.

This law was followed by the publication of an order of the Interstate Commerce Commission, based on an investigation extending over three years, and including the hearing of arguments on every side of the question. This order established (1) a new classification of express matter; (2) a new form of express receipt designed for the information and protection of the shipper; (3) new regulations for collection and delivery service; (4) a new method of determining rates. By this order rates are fixed by dividing the country into five zones, according to density of population and expense of transportation, and by subdividing these zones into blocks. The rate between any point in one block to any point in another block is made clear by a series of tables. The rates on food products are 75 per cent. of the rates on merchandise. These new rates became effective Feb. 1, 1914.

In July, 1915, the Interstate Commerce Commission granted the petition of the express companies to reduce the rail terminal allowance from 25 to 20 cents per 100 lbs., and to increase the col-

lection and delivery service from 20 to 25 cents per shipment.

The Railway Express Agency, owned by 70 railroads, became successor in 1929 to the American Railway Express Company. In 1938 it also acquired the express business of the Southeastern Express Company, then the only other railroad-express agency in the United States.

In addition to railroad express, the Railway Express Agency handled in 1939 virtually all express carried by airlines in the United States; it also had contracts with Pan American Airways.

The revenues of this agency for 1939 totaled $169,982,016. Its operations in 1939 were conducted on 205,858 miles of railroad and 76,513 miles of aircraft and steamship routes. Its offices then numbered 22,895, of which 3,429 were exclusively operated and 16,551 operated jointly with railroads, the remaining 2,915 being offices of the Western Union Company which accepted express for shipment.

Canada. The oldest express company in Canada was founded as the British North America Co. in 1854, reorganized in 1865 and is now part of the Canadian National Express Company, which operates over the lines of the Canadian National Railways. The Canadian Pacific Express, formerly the Dominion Express Co., is connected with the Canadian Pacific Railway. All companies are controlled and supervised by the Board of Railway Commissioners. Express rates must receive the approval of the board before becoming effective, must not be illegally discriminatory or excessive, must not be increased or diminished without prior notice to the public, and may, if necessary, be fixed by the board. In short, so far as the board and the public are concerned, they differ in no way from railway freight rates (see RAILROADS, *Canada*).

Consult E. R. Johnson and T. W. Van Metre's *Principles of Railroad Transportation* (1916); W. H. Chandler's *The Express Service and Rates* (1914) and decisions of the Interstate Commerce Commission, Vol. 59, and decision dated February 11, 1929.

Expunging Resolution, a resolution passed by the U. S. Senate, Jan. 16, 1837, directing the expunging of the previous resolution of that body (passed Mar. 28, 1834) censuring President Jackson for ceasing to use the U. S. Bank as depository of public moneys. It read: 'that the President, in the late executive proceedings in relation to the revenue, has assumed upon himself authority and power not conferred by the Constitution and laws, but in derogation of both.' Jackson in a forcible message (April 15, 1834) protested against this resolution, but the Senate refused to receive the protest. The expunging resolution recited that the resolution of censure 'was not warranted by the Constitution, and was irregularly and illegally adopted by the Senate,' 'and was of evil example and dangerous precedent.'

Extent, a common-law writ of execution, by which defendant's body, goods and lands can all be taken at once to satisfy the judgment. The writ is so named because the sheriff causes lands seized to be appraised at their full extended value. The writ was originally employed to enforce judgments on recognizances or acknowledgments of indebtedness to merchants under the statutes merchant (1285) or staple (1353). In Pennsylvania and several of the New England States the writ is used to give a creditor possession of the debtor's lands for a limited time until the debt be extinguished.

Extenuating Circumstances, facts which may be taken into account in mitigation of punishment, such as youth, previous good character, great temptation, provocation, or that the offender acted under the influence of others. See CRIME.

Extortion, in law, obtaining money or property from a person against his will, by threats or unlawful force, by an officer of the law under the pretence of having the right to do so by virtue of his office.

Extracts, solutions containing one or more substances that have been removed from admixture with others by means of a solvent or menstruum. The solvents most commonly used are water, alcohol, ether, and acetic acid, and the substance extracted simple or complex, whilst the conditions of extraction vary in almost every case. In general, the solvent is poured over the crushed or broken-up substance that it is desired to extract, which is said to be macerated if the solvent is cold, or digested if warm. If the solvent trickles through the substance, the operation is called *percolation*, and the product that is strained off in either case is called an *infusion*. A *decoction* results if the substance is boiled with the solvent. The operation must usually be frequently repeated to remove all the desired substance, and many forms of apparatus have been devised to carry this out with a limited quantity of the solvent.

Extraction is much used in pharmacy, as extracts usually contain a larger proportion of the active principles than the original substance, and they can also be dispensed in a more convenient, palatable, or active condition. The process is also employed in the preparation of alkaloids, natural dyes, the separation of sugar from the beet, and of a sugary solution which can be fermented from malt in the manufacture of beer and whisky. It is also used under the name of 'lixiviation' in the separation of soluble salts from mineral mixtures, and in the recovery of fats and oils from bones, seeds, etc. For details of extracting apparatus, consult Thorpe's *Dictionary of Applied Chemistry*.

Extradition, the surrender by one nation or state to another of a person accused or convicted of crime committed within the jurisdiction of the latter. International extradition is that between independent nations. It was formerly seldom permitted, and then usually only when deemed to be of political service to the sovereign making the surrender. Whether international law makes extradition a legal duty has been the subject of dispute, the great weight of authority being that it is merely a moral obligation based on comity. Within the past one hundred years most nations have recognized that the general welfare was promoted by the punishment of criminals, and that it was disadvantageous for a country to be an asylum for wrongdoers, so that many treaties providing for extradition have been made.

Jay's Treaty of 1794 between the United States and Great Britain provided for extradition in case of murder and forgery, but was operative only for the period of twelve years. It was followed by the Ashburton Treaty of 1842, which added as extraditable crimes assault with intent to murder, piracy, arson, robbery, and utterance of forged paper. This treaty was held not to require extradition for manslaughter, and it contained no provision for burglary, larceny, rape, embezzlement, and other serious offences, so that Canada was a safe harbor for many offenders until 1889, when a treaty was concluded covering all of these offences, and in addition counterfeiting, receiving stolen property, criminal fraud by bailee, agent or director of a company, perjury or subornation thereof, abduction, kidnapping, revolt on a ship and offences against laws as to slavery. In 1900 obtaining money by false pretences, wilful obstruction of railroads and procuring abortion were added. The treaty between the United States and Mexico is broad, adding mayhem to the usual extraditable crimes, Mexico being, with the Netherlands, the only country to provide with the United States for

extradition in case of bribery. The treaty with Mexico does not include perjury.

Extradition treaties are in force between the United States and Argentine Republic, Austria, Belgium, Brazil, Bulgaria, Chile, Columbia, Czechoslovakia, Cuba, Denmark, Ecuador, Esthonia, Finland, France, Germany, Great Britain, Guatemala, Hawaii, Hayti, Italy, Japan, Latavia, Lithuania, Luxemburg, Mexico, Netherlands, Nicaragua, Norway, Panama, Portugal, Peru, Russia, Roumania, Salvador, San Marino, Servia, Siam, Spain, Sweden, Switzerland, Venezuela, Honduras, Paraguay and Uruguay. In England the procedure is regulated by the extradition acts of 1870, 1873 and 1895, and in the United States by Sections 5270 *et seq.* of the Revised Statutes.

A United States judge or commissioner may, upon complaint under oath, arrest the alleged fugitive from justice, and, if evidence which would warrant an ordinary commitment is given, the magistrate so certifies to the Secretary of State, who, upon the requisition of the foreign government concerned, issues a warrant for the surrender of the fugitive. If the magistrate has no jurisdiction, or if the offence charged is not within the treaty, or there is no evidence of criminality, the court will release the fugitive upon habeas corpus proceedings.

The States have no jurisdiction over international extradition. In only one instance, that of Arguelles accused of having sold persons into slavery, who was delivered to Spain in 1864, has the United States surrendered a criminal in the absence of treaty provisions.

Usually citizens of the country of asylum will not be surrendered, and provision is ordinarily made that the fugitive shall not be tried for any offence other than that for which he was extradited until after he has had an opportunity to return to the country surrendering him.

Interstate extradition is provided for in Article 4, Section 2, of the Constitution of the United States: 'A person charged in any State with treason, felony or other crime, who shall flee from justice and be found in another State, shall, on demand of the executive authority of the State from which he fled, be delivered up to be removed to the State having jurisdiction of the crime.'

Extradition may be had for the commission of any act whatever which is made criminal by the statutes of the State where the offence was committed. Upon the requisition of the governor of the State making demand, accompanied by a copy of an indictment or an affidavit showing that a prosecution has actually been commenced for a crime, if the person demanded was personally present in the State where the alleged offence was committed at the time of its commission, it is the duty of the governor of the State where the fugitive is found to cause him to be arrested and delivered up. Notwithstanding the positive terms of the constitutional provision, the performance of this duty cannot be legally compelled, and is sometimes refused. Consult Clarke's *The Law of Extradition;* Moore's *A Treatise on Extradition and International Rendition.*

Extra-Territoriality, the immunity which under certain circumstances members of a foreign state enjoy in a foreign land. It applies to kings, ambassadors, armies, and ships of war. As to ambassadors, see AMBASSADORS. Sovereigns, if not incognito, are not subject to the civil or criminal jurisdiction of a foreign country, unless they choose to submit to it and this same applies to their attendants. The only remedy against a criminal sovereign is to expel him. An army passing through a foreign state in time of peace is subject to the law of the state to which it belongs, but it may not commit breaches of the law of the state through which it is passing. The position of a ship of war in the territorial waters of a friendly country has been hotly disputed, but it is now generally admitted that though a warship should not afford an asylum to criminals, or perhaps slaves, and to political offenders only in cases where they are willing to remain neutral while in asylum, any breach of these rules should be made the subject of international remonstrance, and that no action should be taken against the ship itself. The crews, however, when ashore enjoy no immunity. A merchant vessel when in a foreign port is sometimes thought to be exempt from foreign law in matters which affect its crew alone and do not affect the public of the country; but the alleged rule has never been well established.

The question of extraterritoriality is particularly concerned with the status of Europeans and the people of the United States in many of the Far Eastern countries, notably China, Siam, Persia, Turkey, and Morocco. The difference in the laws and customs of these countries gave rise to the feeling that the Western peoples could not safely be trusted to their jurisdiction. As a result the privileges of extraterritoriality have been secured by means of treaties. It cannot be denied that the question has caused much antagonism and trouble, especially in China, and in 1921, following the Washington Conference, a Commission was appointed to inquire into the whole question. The main issue probably rests on the reformation of the judicial system, and the Commission after careful consideration made certain recommendations in this regard, which if complied with, would warrant the Powers in relinquishing rights of extraterritoriality.

Extravasation, a term used for the escape of any body fluid from its proper vessel. Extravasation of blood results from rupture of the vessel walls and may be produced by crushing or may occur as a result of disease. Extravasation of urine follows rupture of the kidney, ureter, or bladder, from a crush or a blow; fracture of the pelvis is a common cause. Similar organic injuries may produce extravasation of bile, cerebrospinal fluid, lymph, aqueous humor, etc.

Extreme Unction, the last rite of the Roman Catholic Church which is believed to impart to the Christian in death strength to encounter the ordeal of the dying hour. As unction is also used in other rites, the word 'extreme' signifies that this particular anointing is reserved for cases in which immediate death is apprehended. The custom no doubt has its origin in Jas. v: 14, 15, though that passage seems rather to refer to cases in which a cure was expected. The council of Trent, however, decided that the rite was instituted by Christ, and gave it a place among the seven sacraments. It is also found in the Eastern churches, with various modifications. The English reformers retained the practice of extreme unction in the first Prayer Book of Edward VI. in 1549, but it was taken out of the second in 1552.

Exumas, GREAT and LITTLE, two of the Bahama Islands, West Indies. The larger is 30 miles long and 3 miles broad. Little Exuma has an excellent harbor. Pop. 3,500.

Eyck, HUBERT (*c.* 1370–1426), JAN VAN (*c.* 1390–1440), and MARGARET (?1377–1430), brothers and sister, eminent artists, and founders of the Early Flemish school, are supposed to have been born in Maaseyck on the Maas. Tradition credits them with the invention of the art of painting in oils, though this has been disputed. Their method seemes to have consisted in a mixture of oils with resins; but they certainly were the first to perfect the mode of mixing colors, their pictures being famed for their beauty and transparency of coloring. The brothers were employed by Philip of Charolais as painters to the court of The

THE ANGEL MUSICIANS, BY HUBERT VAN EYCK

This painting is a portion of the famous altar-piece in St. Bavon Cathedral, Ghent, Belgium

Eye

Hague in 1422, and Jan to the Duke of Burgundy in Lille. A most important altar-piece was executed by Hubert, assisted by his brother, the subject being *The Adoration of the Lamb*, part of which is in the church of St. Bavon at Ghent, and part in the Berlin Gallery. The chief masterpieces of the brothers are to be found at Ghent, Berlin, Munich, Paris, Antwerp, and Bruges. Three pictures by Jan van Eyck, whose subjects were principally historical portraits and landscapes, are in the National Gallery, London. Two works said to have been painted by Jan are in the Metropolitan Museum, New York. Margaret van Eyck was also a painter, but led a very retired life, being a member of the order of Our Lady of Ghent. She is believed to have executed a series of miniatures for the missal of the Duke of Bedford. See Lalaing's *Jean van Eyck* (1887), and Kämmerer's *Hubert und Jean van Eyck* (1898).

Eye, *Comparative.*—In cyclostomes the eye is simple and degenerate, and in Amphioxus the eye of other chordates is represented merely by a pigment spot. As regards fishes, the modifications present may for the most part be directly associated with the aquatic life. Thus, the cornea is flat, both to prevent injury to the eye in swimming, and because a projecting eye would interfere with the rapidity of movement by increasing the resistance. The lens is unusually large, and is almost spherical; it possesses a high refractive index, and in the position of rest is adapted for the perception of near objects. No very important modifications of optic structure are observable in amphibians or reptiles, but in birds the eyes are large, and elongated in the antero-posterior direction. The mechanism for accommodation is very perfect, and birds can rapidly alter their focus from far to near objects. A striking peculiarity is the presence of a vascular fold of the choroid, called the pecten, which is also present in most reptiles, and appears to be concerned with the nutrition of the parts of the eye. It is homologous with a structure known as the processus falciformis in teleost fishes, but that appears to have to do with accommodation and not with nutrition.

In mammals generally the eye presents the same appearances as in man, except that in aquatic forms, such as the Cetacea, the cornea tends to take on the flattened form seen in fishes. In some mammals, as, for example, in carnivores, there is present in the choroid a glistening layer known as the tapetum lucidum, which is believed to act as a reflector, and so to increase the power of vision in a feeble light; but the common statement that the cat-like carnivores can see in absolute darkness is of course incorrect. The pupil varies in shape in mammals, being sometimes transversely oblong, as in ungulates, or slit-like and vertical, as in the smaller cats. The pecten of birds is in mammals represented only in the fœtus.

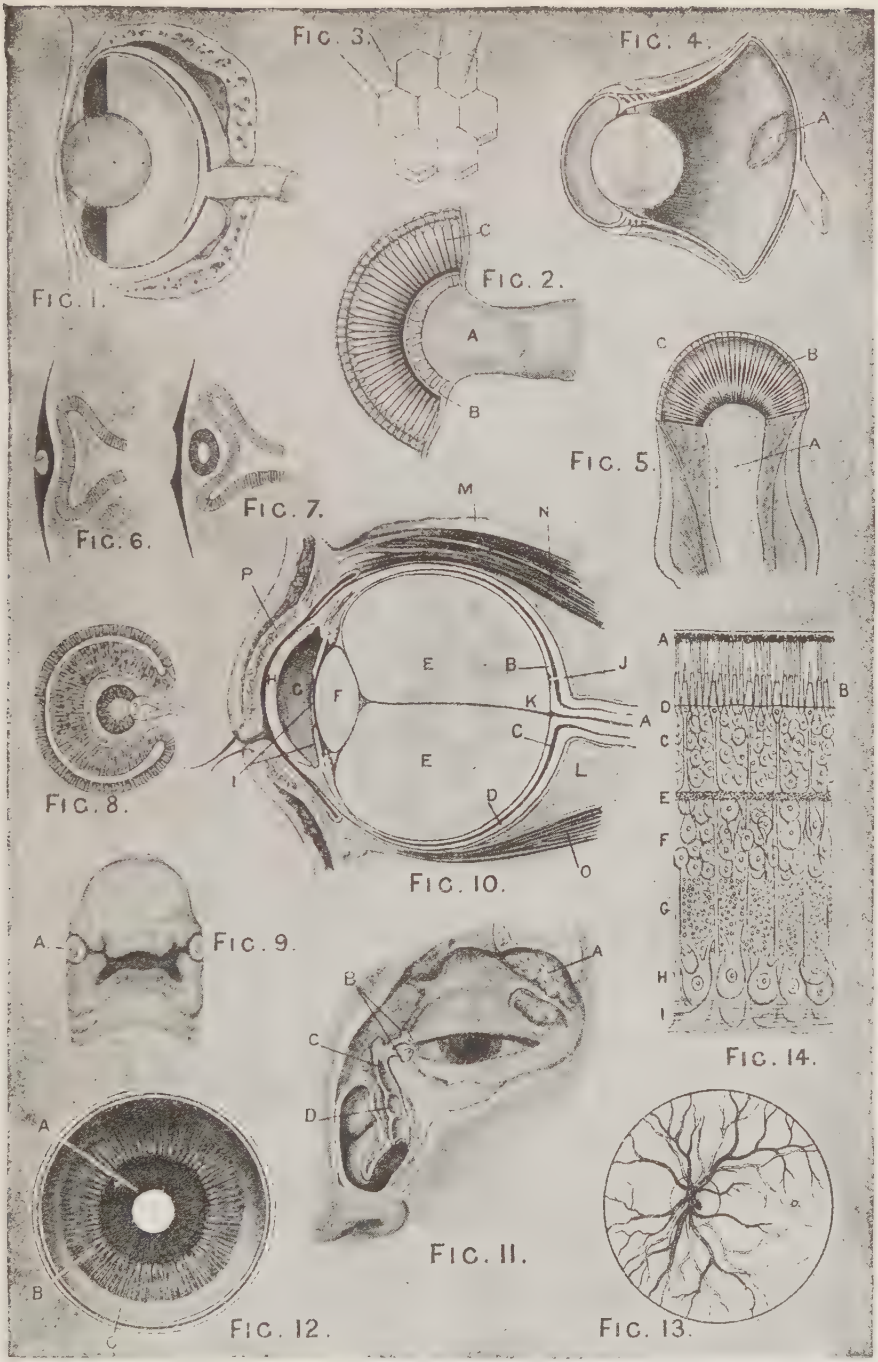
In invertebrates the eye shows an extraordinary range of variation. It may in the simpler forms be little more than a pigment spot, while in the cuttles it reaches a complexity which can only be compared to that of the vertebrate eye, though it has been attained along a different line of specialization. In the cuttles, cornea, lens, iris, and retina are present as in vertebrates.

Among arthropods the eyes are of the type known as compound—that is to say, the eye consists of a large number of eye elements, each made up of a transparent cornea, a transparent ro known as the crystalline cone, and a cluster of percipient elements constituting the retinula, which are connected with the fibrils of the optic nerve. It seems probable that what is seen is a mosaic image, built up of the innumerable small images furnished by the separate eye-elements. Eyes of this type probably have more to do with the perception of movement than with the production of images like those formed in the vertebrate eye. Many arthropods possess, in addition to their compound eyes, simple eyes of a much less specialized nature.

Embryology.—In all invertebrates the eye arises direct from the skin. In vertebrates it originates in large part as an outgrowth from the brain. From the first vesicle of the embryonic brain there grows out at each side towards the body wall an optic vesicle, whose cavity is at first continuous with that of the brain. As this vesicle approaches the skin the latter thickens in front of it, forming the first rudiment of the lens. At the same time the outer wall of the optic vesicle is pushed inwards, and with the further development of the lens and its separation from the skin, the process is carried further, until the outer wall of the optic vesicles fuses with the inner, so as to obliterate the original cavity of the vesicle. In this way the vesicle is converted into a cup, whose opening is filled by the lens. At the same time the portion of the original vesicle which was connected with the cavity of the brain loses its lumen, and becomes gradually metamorphosed into the optic nerve. Of the fused walls of the optic cup, the outer forms the pigmented epithelium of the retina, and the inner the different layers of the retina. Meantime the surrounding mesoblast has entered the cavity of the cup, and there gives rise to the vascular layer of the choroid, the ciliary body, and the iris, as well as to the sclerotic and the inner part of the cornea.

In man each eye moves in an orbit, or bony socket, pyramidal in shape, and so placed that lines produced backward through the centres of both orbits would meet behind the nose. In these bony sockets the eyes (eyeballs) are moved by various attached muscles, those for both working harmoniously together, so that the normal eye always moves with its fellow for precisely the same distance and at the same rate. Should this not be the case, then a divergent or convergent squint is the result. Behind, it is connected with the brain by the optic nerve, which passes through the back of the pyramidal orbit. Each eye has two eyelids or thin movable folds of skin, which cover loose tissue, cartilage, muscle-fibres, blood-vessels, etc., the under or inner surface being lined with conjunctival membrane. The eyelids help to protect the eye from exposure to light, dust, etc. Tears are constantly being secreted from the lachrymal gland, which lies at the outer angle of each eye, slightly above it. The tears pass on to the surface of the eye, through the lachrymal ducts and the action of the lids keeps them constantly flowing towards the inner angle at the nose, carrying with them anything, such as dust, which has fallen on the eye. At the side of the nose the tears enter two canaliculi (little canals), which join at the lachrymal sac, and the canal then runs directly downward, becoming the nasal duct, through which tears are always flowing into the interior of the nose. The edges of the lids show the eyelashes, which serve as screens, preventing large quantities of dust from entering the eye, even when the lids are apart. Under the edges of the lids are rows of Meibomian glands, opening by ducts, and secreting a sebaceous material which prevents the lids from adhering to each other. The movement of the lids is largely reflex.

The conjunctiva lining the inner surface of the lids is often the seat of inflammation (conjunctivitis), which should be treated by local astringents, and sometimes by constitutional treat-



THE EYE.

Fig. 1. Eye of fish, section. **Fig. 2.** Eye of insect (cockchafer), section: A, optic ganglion; B, general retina; C, optic nerves supplying facets of compound eye. **Fig. 3.** Facets of compound eye of bee. **Fig. 4.** Eye of bird (owl), section: A, the pecten. **Fig. 5.** Eye of crustacean (crayfish), section: A, optic ganglion; B, crystalline rods; C, cornea. **Figs. 6, 7, 8, D** velopment of eye in embryo. **Fig. 9.** Head of embryo at five weeks. **Fig. 10.** Human eye, section: A, optic nerve; B, retina; C, choroid; D, sclera; E, vitreous humor; F, lens; G, aqueous humor; H, cornea; I, iris; J, fovea centralis; K, arteria centralis retinæ; L, orbital fat; M, levator palpebræ superioris muscle; N, rectus superior muscle; O, rectus inferior; P, eyelids, with Meibomian glands. **Fig. 11.** A, lachrymal gland; B, lachrymal canal; C, nasal sac; D, nasal duct. **Fig. 12.** A, posterior surface of iris; B, ciliary processes; C, anterior part of choroid. **Fig. 13.** Ophthalmoscopic appearance of the choroid. **Fig. 14.** Microscopic section of the human retina (diagrammatic): A, pigment cells; B, layer of rods and cones; C, outer nuclear layer; D, membrana limitans externa; E outer molecular layer; F, inner nuclear layer; G, inner molecular layer; H, nerve cells; I, nerve fibres.

ment. A common trouble is a stye, which is a small abscess about the root of an eyelash. It is treated by puncture, or by plucking out the lash, and afterwards bathing with a mild antiseptic. An irritable condition of the nerve to the lid often causes constant nervous twitching (blepharospasm). Paralysis of the special muscle to the upper lid causes perpetual droop (ptosis), while paralysis of the orbicularis muscle surrounding the eye prevents it from closing. Ptosis is sometimes congenital. The lids may, by affections of the muscles, the skin, or the conjunctiva, be either everted or inverted (ectropion and entropion). Sometimes, by stricture, concretion, or inflammation, the apparatus for draining away the constantly flowing tears becomes blocked, and watery eye (epiphora) results. Cysts of the Meibomian glands occur, which should be opened.

The eyeball is commonly described as a globe, made up of two segments from a larger and smaller sphere. The smaller segment is to the front, and consists of cornea, covered by mucous membrane (conjunctiva), aqueous humor, and iris. The larger segment, lying behind the smaller, consists (from without inwards) of sclerotic (covered on the front part by conjunctiva), choroid, and retina—three layers or coats of different thickness, structure, and function. The space they enclose holds the vitreous humor, in the front of which lies the crystalline lens, immediately behind the pupil, which is the circular black opening, sometimes dilated, sometimes contracted, in the middle of the iris. On the degree of contraction of the iris the size of the pupil depends. It is the color of the iris which makes an eye blue, or gray, or brown. There is no such thing as a black eye, so far as the iris is concerned. If the pupil or central opening is large then the eye has a darker appearance, and some pupils are usually more dilated than others. The light passes through both conjunctiva and cornea, then through the aqueous humor, lying in the pupillary space, next through the crystalline lens, behind that space, and finally through the vitreous humor, to fall on the sensitive lining of the eye, the retina. At the back of the eye, connecting it with the brain, is the optic nerve, which pierces the sclerotic, choroid, and retina, and appears on the front of the last named, not quite in the centre, as the 'blind spot.' An artery reaches the inside of the eye through this 'blind spot.' The optic nerve then branches out all over the dark, inner surface or front of the retina, making it sensitive to light. The different parts of the eye and their disorders are dealt with under their various headings, and under VISION and BLIND. The delicate mucous membrane (conjunctiva) is so sensitive that it acts as sentinel to the eye, giving warning of the slightest irritation to the surface. It is always moist and shining, from the tears which constantly cross from the lachrymal gland to the lachrymal sac. The cornea is thicker and harder than the conjunctiva, elastic, tough, and transparent, and is practically a continuation of the sclerotic forward, the sclerotic being the outermost coat on the posterior five-sixths of the whole globe of the eye, while the cornea covers the remaining and foremost sixth, the smaller segment of a sphere already spoken of. Behind the cornea lies aqueous humor, continually bathing the lens, which, as it were, hangs in the pupil of the eye, a little behind the curtain-like iris. The contraction and relaxation of the iris, with accompanying changes in the lens, are called accommodation. While open in the centre, to form the pupil, the iris is attached all round its outer edge to the back of the cornea. The iris is the continuation forward of the choroid—that second coat which in the posterior five-sixths of the globe lies within the sclerotic. Sclerotic and choroid are loosely attached to each other. The crystalline lens, lying in the pupil immediately behind the iris, is attached to the choroid by a circular ligament, the suspensory ligament. The lens is transparent, convex before and behind, the convexity tending to decrease with age as elasticity is lost. Accommodation of the eye to objects at short or long distances is produced by altering the convexity of the lens, through the ciliary muscles, which makes taut or loose the suspensory ligament. Contraction of the muscle loosens the ligament. (See VISION.) While the iris, when contracting to lessen the pupil, acts as a curtain to cut off rays of light from the outer edge of the lens, the lens itself, because of its double convexity, brings to a focus on the retina those rays which pass through it. If the lens is too convex, then the rays are brought to a focus before they reach the retina. Commonly, however, this happens not because of a faulty lens, but because the eye is too long from before backwards. In the case of a far-sighted person again, the fault is not in the lens (unless through age), but depends on the fact that the distance is too short between the lens and the retina. Thus rays are focussed behind the retina when the eye examines a near object. The aqueous humor in front of the lens is, as its name suggests, thin and watery. The vitreous humor, filling the space between the back of the lens and the retina, is jelly-like. Both are transparent, as is everything that lies before the retina. Hence by throwing a strong light on the centre of the eye you can look through the pupil and examine the retina, which shows as a pink surface, with darker red lines wandering over it. These are blood-vessels. The retina is the part of the eye which, one may say, all other parts combine to help. Without it there is no sight. Rays of light do not produce the image of an object until they fall upon the retina. It receives the impression and transmits it to the brain through the optic nerve. It is a very thin, yellowish-gray membrane, as seen when the eye is cut open. Relatively the most essential parts of the retina are the rods and cones. At the centre is the yellow spot, which seems to have an acuter vision than any other part of the retina. If we wish to see an object clearly, we must look straight at it, so that the rays of light from it may fall upon the yellow spot.

Eyebright (*Euphrasia officinalis*), small European annual plant belonging to the Scrophulariaceæ. It has ovate, dentate leaves, and bears in early autumn numerous, almost sessile, white or purplish flowers in the axils of the leaves. It is especially common near the sea. It has a bitter taste, and was formerly much used as a remedy for diseases of the eye.

Eyra (*Felis eyra*), a small American cat, about the size of the domestic cat, but remarkable for the elongation of the body, which resembles that of a weasel, and for the uniform, reddish, unspotted coloration. It attacks domestic fowls, and is apparently very bloodthirsty in disposition. It inhabits the E. region of S. America, and northwards to Texas.

Eyre, large salt lake to the N. of Spencer Gulf, S.Australia (137° E. and 28½°S.). In seasons of drought it is little better than a swamp or mud-flat encrusted with salt.

Eyre, JUSTICES IN. Justices in eyre, or *in itinere*, were established in the year 1176, with a delegated power from the king's great court to visit the counties and hear all pleas. Three or four of the permanent justices sat, with several important personages of the county, as an abbot or bishop, associated with them. Their functions were twofold—first, to

protect the king's interests; secondly, to try law-suits and indictments. The justices made a searching inquiry of the local juries, addressing them with a long list of interrogatories called Articles of Eyre, in which they inquired minutely as to royal property and franchises, the misdoings of officers, crimes committed, and as to all the happenings in the county since the last eyre. At first eyres were intended to take place once in seven years, but they were sorely burdensome and unpopular, and in the 14th century they became rare and finally obsolete, being supplanted by the common-law courts and their circuits. See Pollock and Maitland's *History of English Law* (2d ed. 1898), and Holdsworth's *History of English Law* (1903).

Eyre, Edward John (1815–1901), English governor of Jamaica, born in England. He emigrated to Australia, and became a squatter on the Lower Murray. He proved the practicability of an overland route between S. and W. Australia, and described his journeys in *Discoveries in Central Australia* (1845). He was appointed lieutenant-governor of New Zealand by Earl Grey (1846), promoted to the W. Indies (1854), and in 1862 was appointed governor of Jamaica. In consequence, however, of the stern measures which he took to suppress a rebellion which arose in October, 1865, he was superseded, and prosecuted at the instigation of a committee presided over by John Stuart Mill. Another committee, raised to provide funds for his defence, included Carlyle and Kingsley. He was acquitted in April, 1867, and the cost of his defence (nearly £10,000) was refunded by the government.

Eyre's Peninsula, S. Australia, lies between Spencer Gulf on the E. and Anxious Bay on the W.

Ezekiel, a Hebrew prophet, was one of the temple priests deported to Babylon by Nebuchadnezzar, 597 B.C. (Ezek. 1 : 2, 3; 2 Kings 24 : 14 *f.*). Ezekiel received the prophetic call in the fifth year of his exile, and his message at first consisted largely of denunciations of his countrymen both in Babylon and Palestine; but after the fall of Jerusalem, in 563 B.C., he became a prophet of consolation, promising the eventual deliverance and restoration of the chosen people. The book of his prophecy is generally divided as follows:—(1) Ch. 1–24, prophecies relating to Israel and Judah, in which he foretells and justifies the fall of Jerusalem; (2) ch. 25–32, denunciations of the neighboring nations; (3) ch. 33–39, predictions of the restitution and union of Judah and Israel; and (4) ch. 40–48, visions of the ideal theocracy and its institutions. Ezekiel develops the doctrine of individual responsibility (ch. 18), and of the Messianic kingdom, as no prophet before him. His style is not of the highest order, but is extraordinarily rich and striking in its imagery. The authenticity of the book is admitted all but universally, but the corrupt state of the Hebrew text is notorious. See commentaries by Keil (1843 trans.), Hitzig (1848; revised by Smend, 1880), Orelli (1888), A. B. Davidson in *Cambridge Bible* (189?), Skinner in *Expositor's Bible* (1895), Bertholet (1897); mention should also be made of Cornill's brilliant attempt to reconstruct the Hebrew text with the aid of the Septuagint (1886).

Ezekiel, Moses [Jacob] (1844–1917), American sculptor, born in Richmond, Va., and after serving in the Confederate army, graduated (1866) at the Virginia Military Institute. He studied sculpture at the Royal Academy in Berlin (1869), where his colossal bust of Washington gained him admission to the Society of Artists, and where he took the Michael Beer prize, then first won by a foreigner. Mr. Ezekiel established his studio at Rome, where he afterward resided. Among his most important sculptures are *Religious Liberty* (in Fairmount Park, Philadelphia), *Apollo and Mercury* (in Berlin), *Christ in the Tomb*, *Judith* (in the Cincinnati Museum), and the *Jefferson Monument* at Louisville, Ky., besides numerous portrait busts and memorial pieces. His work is characterized by great technical skill in the carving, and he was the first to introduce the German and new Italian styles of sculpture to this country.

Ezra, 'the scribe,' was one of the Jewish captives in Babylon under Artaxerxes I. (Longimanus). In 458 B.C. he obtained an edict empowering him to conduct a band of fellow-exiles to Jerusalem, and to reorganize the community there on the basis of the law. According to Ezra i., a large number of Jews had already returned in the reign of Cyrus (537); but they had become indifferent to the law, and had contracted marriages with heathen wives. On his arrival at Jerusalem, Ezra compelled a general divorce, but deferred promulgating the law till the arrival of Nehemiah, 444 (Neh. 8), in conjunction with whom he organized the Jewish hagiocracy. Jewish tradition makes him the restorer of all the pre-exilic literature, which is alleged to have been destroyed at the fall of Jerusalem. Some modern critics regard him as the compiler of the Hexateuch, but more recent opinion tends to identify the law he promulgated with the stratum known as P. See next article, and Esdras (The Books of).

Ezra and **Nehemiah,** The Books of. These formed originally a single document, both in the Jewish and Christian canons, and are the continuation of the Books of Chronicles. They cover a period of over a hundred years, and deal with the return of the Jews from the exile and the organization of Judaism, but with large lacunæ, giving only a few outstanding features. They record the first return under Zerubbabel (537 B.C.), and the frustrated attempt to rebuild the temple (Ezra 1–4); a renewed and successful endeavor with the authority of Darius, 515 B.C. (ch. 5, 6); a second return under Ezra, 458 B.C. (ch. 7–10); Nehemiah's return, 444 B.C., and the construction of the wall of Jerusalem (Neh. 1–7); the promulgation of the law by Ezra (ch. 8–10); a catalogue of Jewish families and priests (ch. 11, 12:26); the dedication of the walls, the regulation of the temple services, and Nehemiah's second visit (12:27–13). The chronicler has incorporated fragments of the personal memoirs of both Ezra and Nehemiah (Ezra 7:27–9:15; Neh. 1–7:23; parts of ch. 12 and 13); Ezra 4:8–6:18 is written in Aramaic, as is also 7:12–26, the firman of Artaxerxes; the list in Ezra 2 is duplicated in Neh. 7:6–73. Professor Kosters of Leiden has questioned the reality of the first return under Zerubbabel (cf. *Het Herstel van Israel in het Perzische Tijdvak*, 1894, and *Expos. Times*, vol. viii.). See *Ezra and Nehemiah* in Cambridge Bible by Ryle (1893), and in Men of the Bible Series by Rawlinson; Driver's *Intro. to the Lit. of O.T.* (6th ed. 1897, p. 540 *ff.*); Torrey's *Composition and Historic Value of Ezra and Nehemiah* (1896).

Ezra Church, or **Ezra Chapel,** Battle of, a battle of the Atlanta Campaign during the American Civil War, fought on July 28, 1864. After the battle of Atlanta (July 22) Sherman decided to operate against the city from the W. and S. rather than from the N. and E., his principal object being to gain control of the Macon railroad, upon which Hood's tenure of Atlanta depended. He accordingly sent Gen. Howard with two corps of the Army of the Tennessee from the extreme left to the extreme right, and near Ezra Church, a short distance W. of the city, Howard was unsuccessfully attacked by Hood, the Confederates losing about 4,600, the Federals about 700.

Ez Zebedani, tn., Palestine, 20 m. N.W. of Damascus. Pop. 35 000.

F, the sixth letter in the English and Latin alphabets. The original symbol in the Egyptian hieroglyphs was the picture of a cerastes or horned asp; the horns being represented by the two horizontal bars in our F, and the body by the vertical stroke. When the Egyptian sign was adopted by the Phœnicians it received the name of *Vau*, from the resemblance to a nail or peg. From the Phœnicians it passed into the early Greek alphabet as a semi-vowel, but at some time previous to the oldest extant Greek inscriptions it was differentiated into two characters, one of which, **F**, had the sound of *w*, and the other, **V**, with the name *upsilon*, became a vowel. As early as the seventh century B.C. the character F became obsolete as a letter in the Eastern Greek alphabet, being retained only as the numeral for six. In the Western alphabet, which was used chiefly in the Peloponnesus, F was retained as a letter till the fifth century B.C. From the Chalcidian alphabet it was transmitted to Italy, retaining its position as the sixth letter, but acquiring in Latin the sound of *f* instead of *v* or *w*. This sound *f* is called a labiodental fricative, and is formed by bringing the lower lip into contact with the upper teeth.

F, in music, is the fourth tone of the natural scale of C. It is the chemical symbol for fluorine.

F., Fahr., abbreviations for 'Fahrenheit.'

f. and **ff.,** abbreviations for 'following,' and (in music) 'loudly,' 'very loudly.'

Faber, CECILIA. See CABALLERO, FERNAN.

Faber, FREDERICK WILLIAM (1814–63), English theologian and hymn writer, was born in Calverley, Yorkshire. He was rector of Elton in Huntingdonshire from 1842 to 1845, but in the latter year followed the example of his master, Newman, and went over to the Roman Catholic Church. He published a *Life of St. Wilfrid* in 1844, and founded a community at Birmingham under the title of Brothers of the Will of God, which was merged in the Oratory of St. Philip Neri (1848). In 1849 a branch of the oratory was established in London by Faber and Father Hutchinson. The community was erected into a separate congregation in 1850, and in 1854 was removed to Brompton. Faber published a number of theological works, but is best remembered by his hymns, *O Paradise, O Paradise; O Saviour, bless us ere we go; Pilgrims of the Night*, and others.

Faber, GEORGE STANLEY (1773–1854), English theologian, was born in Calverley, Yorkshire. He was educated at Oxford, was vicar of Stockton-on-Tees and elsewhere, and in 1832 became master of Sherburn Hospital. He promulgated his antiquarian views chiefly in *Horæ Mosaicæ* (1801, Bampton lecture), and in *The Origin of Pagan Idolatry* (1816). He showed best his strong evangelical sympathies in treatises on *The Primitive Doctrine of Election* (1836) and on *The Primitive Doctrine of Justification* (1837).

Faber, JOHN, the elder (?1660–1721), English draughtsman, a native of The Hague, set up a print shop in London, and practised as a mezzotint engraver. He is noted chiefly for his pen portraits on vellum and his engravings, of which those of the founders of the Oxford and Cambridge colleges are best known.

His more famous son, JOHN FABER the younger (?1695–1756), is noted for mezzotint engravings of historical and domestic subjects, and his portraits, including those of Miss Jane Collier, Charles II., Ignatius Loyola, The Beauties of Hampton Court, and members of The Kit-Cat Club.

Fabia Gens, fā'bi-*a* jenz, a patrician house of ancient Rome. The most famous of its members were as follows: (1) CAESO FABIUS VIBULANUS was consul in 484, 481, and 479 B.C. Overcome in his efforts on behalf of the plebeians, by the opposition of the patricians, he quitted Rome with all his clan. They established themselves on the banks of the Cremera, and for two years harassed the people of Veii; but in 477 they were ambushed by the latter, and 306 of them slain—only one youth being left to perpetuate the family. Mommsen considers that the whole story is a legend based on the practice of the private war.

(2) QUINTUS FABIUS MAXIMUS RULLIANUS, consul six times between 322 and 295 B.C., was the greatest Roman general in the Second Samnite War. In 295 he gained the decisive victory of Sentinum over the allied Gauls and Samnites.

(3) Q. FABIUS MAXIMUS, variously nicknamed *Cunctator*, or the 'Delayer,' *Verrucosus*, 'warty,' and *Ovicula*, 'sheep,' from the mildness of his temper, was consul in the years 233, 228, 215, 214, and 209 B.C., censor in 230, and dictator in 221 and 217. He was generally regarded as the saviour of Rome in the war against Hannibal; his cautious policy of abstaining from pitched battles, and of harassing his opponent in his marches and at every turn, gradually wore out the strength of the Carthaginians. In 215 Fabius ravaged Campania, began the siege of Capua, and recaptured Tarentum (209 B.C.). In his later years he opposed the aggressive policy of Scipio.

(4) Q. FABIUS PICTOR, who served in the Gallic War (225 B.C.), and also in the Second Punic War, is the earliest prose historian of Rome. His history, written in Greek, covered the period from the landing of Æneas in Italy to his own time.

Fa'bian Society, an English socialist organization founded in 1884. It was started in London by a small group of people under the leadership of Thomas Davidson, an American, who was interested in social progress. The founders repudiated all violent and sudden methods of propagandism, and it has labored principally through lectures and tracts, some of which have exerted a wide influence. Its members have also entered largely into municipal politics, particularly in London, and have done much to promote there and in other cities what is known as 'municipal socialism.'

The Fabian Society aims at the reorganization of society by the emancipation of land and industrial capital from individual and class ownership and the vesting of them in the community for the general benefit. For the attainment of these ends it looks to the spread of Socialist opinions by the dissemination of knowledge as to the relation between the individual and society. Among the more notable of its publications are *The Workmen's Compensation Act*, *The Case for State Pensions in Old Age*, *Women and the Factory Acts*, *Capital and Land*, *Facts for Socialists*, and *The Fabian Essays*. It also issues a useful bibliography of social economics, entitled *What to Read*.

Fable (Lat. *fabula*, 'a story'), a moral apologue or parable of a more or less humorous kind, in which the actors and speakers are usually animals, though plants and occasionally human beings may appear among the characters. Of genuine fables

the greater number are associated with the name of Æsop (q. v.). The collection formed by Planudes of Constantinople in the first half of the fourteenth century has much in common with the metrical Greek fables of Babrius, who probably lived in the first century B.C., and again with the Latin fables of Phædrus, a freedman of Augustus, the ultimate source being the same—the Buddhist birth-stories and other Indian tales, which had long before been gradually finding their way westward through Arab or still more obscure channels.

The mediæval examples of the fable follow closely two Latin versions. The Latin *Romulus* was enlarged about the eleventh century by a number of fables of quite a different character, bearing in the highest degree the stamp of the Middle Ages, and often of Christianity (as in that of the wolf who learns to read), coming in great part from India, by way of Byzantium, frequently poorly told, usually obscure, but often original, well invented, and of a popular character, as in that of the cat that has put on a stole in order to baptize a rat which wishes to remain a pagan. It was from the lost English version of this enlarged collection that it was translated, in the reign of Henry II., by Marie de France, into elegant but somewhat dry French verses. She gave her work the name of *Isopet*, a familiar diminutive of the name of Æsop.

Besides these special collections of fables, the best and most original examples, whether in French or Latin, are often to be found in the works of the moralists, the preachers, and even the historians. From the twelfth century there were often inserted in sermons *Exempla*, or short tales, sometimes edifying in themselves, sometimes having the character of parables or even merry stories, from which a moral was extorted.

The greatest of modern fabulists was La Fontaine (q. v.). Florian (q. v.) ranks next to him among French fabulists. Noted German fabulists were Christian Gellert and Gotthold Lessing (qq. v.). English verse fables have been written by Dryden, Prior, and Gay. Rostand's *Chantecler* and Maeterlinck's *The Blue Bird* are fables in dramatic form.

See Æsop; Hitopadesa; Reynard the Fox.

Fabliaux, fȧ-blē-ō′, short satirical verse tales of old France, full of a spirit of mischievous and free-spoken jollity. Two hundred or so are in existence, dating between the end of the twelfth and the end of the fourteenth century, and belonging chiefly to Picardy, Normandy, and the Isle of France. In Italy they took a prose form, as in Boccaccio's *Decameron*, etc. In England, Chaucer wrote what are really *fabliaux*, but with greater poetical genius and less coarseness. In France itself the *Cent nouvelles nouvelles* are to all intents and purposes prose *fabliaux*. The most complete collection is that by De Montaiglon and G. Raynaud (6 vols., 1872–90).

Fabre, fȧ-br′, Ferdinand (1830–98), French novelist, was born in Bédarieux, in Hérault. He produced his first novel, *Les Courbezon*, in 1862, and followed this by others dealing principally with the country life and manners of Hérault, and introducing descriptions of priestly life charming in their simplicity and truth. He was curator of the Mazarin Library from 1883 until his death. Fabre's principal novels are *Le Chevrier* (1868), *L'Abbé Tigrane* (1875), *Mon oncle Celestin* (1881), and *Lucifer* (1884). Consult his *Ma vocation* (1889) and *Ma jeunesse* (1903).

Fabre, Jean Henri (1823–1915), French entomologist, was born in St. Léons, Aveyron. He was educated at Vaucluse and became professor of mathematics and physics in the College of Ajaccio in Avignon. In early life he interested himself in insects and eventually devoted his life to a study of their habits. He was made a chevalier of the Legion of Honor in 1867. His publications include *Souvenirs entomologiques* (10 vols. 1879–1907); *Le livre d'histoire* (1868); *De sciences naturelles* (1875); *Le vie des insects* (1911). The English translations *Insect Life* (1901), *Life and Love of the Insect* (1911), *The Life of the Spider* (1913), *The Life of the Fly* (1913), *The Mason Bees* (1914), *The Hunting Wasps* (1915), and *Our Humble Helpers* (1918), are all taken from the great *Souvenirs*.

Fabretti, fȧ-bret′tē, Raffaelo (1618–1700), Italian antiquary, was born in Urbino. He became a canon of the Vatican, prefect of the Holy Cemeteries, and devoted his leisure to studying antiquities. Innocent XII. made him keeper of the papal archives in the castle of Sant' Angelo at Rome. His chief works are *De Aquis et Aquæductibus Veteris Romæ* (1680); *De Columna Trajani Syntagma* (1683); and *Inscriptionum Antiquarum Descriptio* (1699), dealing with the catacombs.

Fabriano, fȧ-brē-ä′nō, Gentile di Niccolo di Giovanni Massi da, called Gentile da Fabriano (1360–1428), Italian painter; first great master of the Umbrian school. For his first patron, Pandolfo Malatesta, he decorated a chapel at Brescia; he then went to Venice, where, with Pisanello, he executed frescoes in the ducal palace, and also received Jacopo Bellini as a pupil. Later he lived in Florence, where he painted for the church of the Trinita his chief work, *The Adoration of the Kings*, 1423 (Academy, Florence). He had a fine sense of color and feeling for beauty, and delighted in expressing the mediæval ideal of terrestrial happiness by decorating his panels with embossed and incised gold, his foregrounds with exquisite flowers, his figures with jewelled trappings.

Fabricius, Eng. Lat. fa-brish′i-us (full name, Gaius Fabricius Luscinus) was probably a settler in Rome from the Hernician town of Aletna. As consul he gained great victories over the Lucanians, Bruttians, and Samnites (282 B.C.); in 280 was present at the battle of Heraclea, in which Pyrrhus defeated the Romans; and the same year was sent to negotiate an exchange of prisoners with Pyrrhus. When the king tried to gain him over to his side with magnificent presents Fabricius refused. In 279 he was again in the Roman army which Pyrrhus defeated at Asculum, and in the next year was consul and negotiated a peace with Pyrrhus. In 275 he was censor, and distinguished himself by his stern repression of luxury.

Fabricius, fȧ-brēt′si-ŏŏs, Johannes Albertus (1668–1736), German classical scholar, was born in Leipzig. In 1699 he was appointed professor of rhetoric and moral philosophy in the gymnasium of Hamburg, where he remained till his death. He is regarded as the founder of the history of classical literature. His most celebrated works are *Bibliotheca Latina* (1697), *Bibliotheca Græca* (14 vols., 1705–28), *Bibliographia Antiquaria* (1713), *Bibliotheca Ecclesiastica* (1718), and *Bibliotheca Latina Mediæ et Infimæ Ætatis* (1734). There is a Latin *Life* by Reimarus (1737).

Fabrics, Textile. The word textiles is applied to all woven fabrics, whether plain or ornamented. The most simple form is that in which the threads cross at right angles, passing over and under each other in regular order, and a great variety of goods are thus made. By the use of variously colored threads, checks and stripes are produced, as in the plaids of the Scottish clans. By the use of threads of varying thickness a corded effect is obtained, as shown in articles of the *repp* order. *Crêpe* is made by using hard twisted threads, so that the cloth, when taken out of the loom, shrinks or puckers. The French *crêpon* is manufactured in the

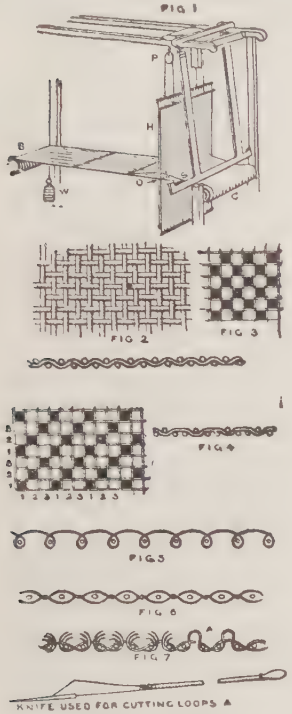
Fabrics

same way. With softly twisted woollen yarns and loose weaving the goods can be milled, or felted into a firm texture, as in the case of broadcloth. Teasling up of the fibres produces a hairy surface, in imitation of the skin of animals, such as is seen in some blankets. Perhaps the most important development of a plain 'weave' is the production of *pile* fabrics. These are woven with two warps, one of which is looped over transverse wires, and stands out above the main body of the cloth; when these loops remain uncut the cloth is named *terry*, in carpets *Brussels*. When the loops are cut so as to form a brushlike surface *velvet* is the result; in carpets a similar treatment is known as *Wilton*. *Plush* is produced by the loops on one side being cut longer than on the other. Pile fabrics are also made with extra wefts in place of two warps; *velveteen*, *justian*, *corduroy*, are illustrations of this method. Another modification of the plain weave is *chenille*, which is used with beautiful results in tapestry and carpets. Chenille is a fringe thread. It is woven in a piece and cut into strips, each of which has two brushlike surfaces; when twisted, the brush effect is observable all round the thread, which is then employed as weft over various kinds of warp, and produces goods of great richness. The variety of fabrics may be further increased by altering the weave. If the cross threads be woven over and under each other irregularly, a great variety of designs may be shown on the surface of the cloth, and still further increased by varied colors. The most simple form of this weave is *twill*, where the cross thread passes over two, three, or more warp threads at a time. This may be greatly varied. *Satin*, which is the term applied to silk, as *sateen* is to cotton goods, and which presents a polished surface, is woven by this method. More complicated forms of this weave produce *damasks*. *Brocade* effects are obtained in a similar manner by extra wefts. The principle of the twill is thus capable of being applied to warp as well as to weft. *Gauze* is another important variation of fabric. The warp threads are twisted round each other by an arrangement known as the 'doup'; the result is an effect not unlike a fishing net on small scale, the threads being locked together at crossing. Many elegant and airy fabrics are produced in this way, especially in silk. *Leno* weaving in cotton is of a similar description. Combinations and modifications of these various weaves and modes of finishing enable manufacturers to produce endless variety of textile fabrics.

Historically, textile fabrics are of ancient date. In the book of Exodus we read of 'the cunning workman, and of the embroiderer, in blue, and in purple, in scarlet, and in fine linen, and of the weaver.' The Egyptians were celebrated at an early period of the world's history for their textile fabrics. From Homer and other writers we learn of the weaving of the Greeks, wool being the material chiefly in use. Patterns, designs, mythological subjects, etc., were worked upon their tapestries. Sufficient fragments have been found to prove that in skill of work and beauty of design the Greeks, Romans, Egyptians, Assyrians, Persians, Sicilians, were far advanced at an early period. Byzantium, in textiles as in much else, stood alone, combining the knowledge of East and West—simplicity of the Greek with the Eastern love of display. In Justinian's reign the Byzantine weavers first used silk in their looms; silk was used in China two thousand years B.C. In the 12th century we find English textile fabrics in demand in Europe. In the 14th century the art of weaving reached its highest point: witness the tapestries at Coventry, representing the marriage of Henry VI. In the 15th and 16th centuries magnificent tapestries, or 'storied wall-hangings,' were being manufactured in Arras, Brussels, etc. In the 17th and 18th centuries Gobelins and Beauvais tapestries became famous. William Morris says: 'There are several ways of ornamenting a cloth—(1) real tapestry, (2) carpet weaving, (3) mechanical weaving, (4) printing or painting, and (5) embroidery. There has been no improvement (indeed, as to the

Tapestry Design, 'Flora.' Executed by Morris & Co.
(Figure by Sir Edward Burne-Jones; ornament by William Morris, 1886.)

main processes, no change) in the manufacture of the wares in all these branches since the 14th century.' With this belief Morris strove to awaken the interest in textile fabrics, and exquisite



Textile Fabrics.

Fig. 1. Diagram of weaving: B, warp on roller; H, healds or heddles, raised by pulley P, and lifting warp threads at o for shuttle s to pass with weft threads. Fig. 2. Texture of plain cloth and section. Fig. 3. Cardboard pattern used in power loom to produce plain cloth. The black squares show weft passing over warp. Fig. 4. Cardboard pattern for twill cloth, and section of cloth. Fig. 5. Lace fabric, section. Fig. 6. Gauze—warp threads crossing each other between the casts of the shuttle. Fig. 7. Velvet—weft threads forming loops which are then cut to form a pile.

work came from his looms. See his lecture on Textiles in *Arts and Crafts Essays* (1899); Ashenhurst's *Weaving and Designing of Textile Fabrics* (5th ed. 1893); Beaumont's *Woollen and Worsted Cloth Manufacture* (3d ed. 1899); Posselt's *Technology of Textile Design* (1889) and *The Jacquard Machine Analyzed and Explained* (1893); Taylor's *Cotton Weaving and Designing* (1893); Matthews, *Textile Fabrics* (1904). See also COTTON, LINEN, LACE, JUTE and SILK.

Fabriano, tn. and episc. see, prov. Ancona, Italy, at the E. foot of the Apennines, 44 m. S.W. of Ancona by rail, with paper and other mills. Pop. 22,996.

Fabroni, ANGELO (1732–1803), Italian biographer, born at Marradi; after being prior of the Church of San Lorenzo, Florence (1767), became tutor to the sons of Leopold, Grand Duke of Tuscany (1773). A conscientious and reliable biographer, he has been well called the 'Plutarch of Modern Italy.' He published in 1778–1805 *Vitæ Italorum Doctrina Excellentium* in twenty volumes. Among his most famous biographies are those of *Cosmo de' Medici*, *Lorenzo de' Medici*, and *Leo X.* See his Life, contained in vol. xix. of his *Lives*.

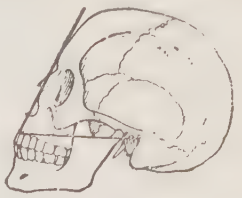
Fabyan, ROBERT (d. 1513), English chronicler, was a wealthy London clothier. His literary interest is shown in *The Concordance of Histories*, printed in 1516 as *The New Chronicles of England and France*, a general history of England and later of France, of value only for a few details after the reign of Richard I., when it becomes a London chronicle. See Ellis's Introduction to his edition of *The New Chronicles* (1811).

Façade, the name applied to the front of a building. Originally it described the outline of the ends of an aisle with sloping roofs, as in Italian mediæval construction. But in the 13th century it was adopted as a complete design, being found in secular and in ecclesiastical architecture. In the latter case it usually signifies the principal or west front. The typical Italian façade is pedimented. In England, when it is used in this relation the tower of German and French usage generally flanks each side.

Facatativa, tn. of Cundinamarca, Colombia, 20 m. by rail N.W. of Bogota. Near at hand are interesting carved stones. Alt. 8,480 ft. Pop. 7,500.

Facciolati, or FACCIOLATO, JACOPO (1682–1769), Italian philologist, born at Torreglia, near Padua, where at the seminary he became (1704) professor of philosophy, and finally rector (1707), and from 1723 to 1755 was professor of logic at the university. Between 1715 and 1719 he brought out a new edition of the *Dictionarium undecim Linguarum*. In the compilation of this work he was assisted by his pupil Forcellini, and the same two scholars began the *Totius Latinitatis Lexicon* (1771; new ed. 1864; Eng. ed. 1842). Facciolati was responsible for several good editions of the classics, and other works.

Facial Angle, a craniometrical expression, denoting the angle between the facial line (a line drawn downward from the forehead to the nostrils) and another line drawn horizontally from the nostrils to the ear. In general, the more acute this angle the lower is the type. The ideal Greek face indicates a right angle as the facial angle. The Dutch anatomist Camper (1722–89) originated the above method of estimating the facial angle; but Kollmann and others subsequently adopted alternative systems. See ANTHROPOLOGY.



Facial Angle.

Factor. (1.) In arithmetic, where numbers are multiplied together, the resulting figure is called the product, and each of the numbers multiplied is said to be a 'factor' of the product. A factor which cannot be divided without remainder by any number except itself and unity is called a 'prime factor.' In algebra, each of two or more expressions multiplied together so as to form a product is called a factor. Thus *a*, *b*, and *c* are factors of the product *abc*. (2.) A special kind of agent for the sale of merchandise on commission. He is given possession of the goods which he is to sell, and delivers them to the purchaser after effecting the sale. A factor frequently deals with his customers as if he were the principal or owner of the goods, and may become responsible to them for any guaranty or breach of contract. If he names his principal, however, the general rules of agency prevail, and he cannot be held personally liable. Factors sometimes expressly guarantee the credit of their customers to their principals, thus becoming responsible for payment. In such cases they usually receive a larger commission than for a mere sale. A factor often makes an advance to the consignor or principal on account of the goods, in which case he acquires a special interest in them, and the principal must allow them to remain in his hands for sale. In the United States, agents of this kind are more frequently known as commission merchants, but the rules of law applicable to their business are the same. See PRINCIPAL AND AGENT.

Factors Acts. The name applied to statutes in the United States and England, enacted for the protection of persons dealing with factors or agents having possession of goods for sale. Under these acts, if a factor sells or pledges the goods in his hands

to an innocent person, in violation of his principal's instructions, the transaction is valid as against the latter. By the common law, a factor could not pledge the goods intrusted to him, and innocent persons were easily defrauded in this way by dishonest factors, but the above statutes remedy this defect in the law. See FACTOR; PRINCIPAL AND AGENT.

Factory Acts. Labor legislation dealing with working conditions has a long and troubled history. It represents that side of labor legislation which requires officials for continuous inspection and enforcement; dealing with health, safety, hours, child labor, wages, etc. Early factory acts required no special officers, the theory being that employees would complain of violations; but this proved a mistaken theory, employees fearing discharge if they informed. In England in 1833, in the 1870's in America, and in some countries earlier, regular inspection and policing started; Massachusetts in 1879 passing a particularly thorough law. Today the most liberal opinion is that the system is still inadequate, inspectors being as a rule untrained, poorly paid, overworked, without hope of advance, etc.

The conception of a factory and acceptable labor conditions has greatly changed since the earliest industrial times, when little or no concern was felt for the health, safety, comfort, earnings, age and conditions surrounding workers. In the rapid expansion period in England between 1793 and 1815 old barns, cart houses, etc., were impressed into service as factories with inhuman disregard of workers. Employees not being in a position to stipulate conditions, callous or grasping employers from early factory days onward neglected such considerations, unless pressed by state regulation.

Industrial hygiene as early as 1700 was on the conscience of forward-looking persons. Ramazzini in Italy in that year published his *De Morbis Artificium Diatraba* a book which made a deep impression all over Europe for a long time and laid the first basis for scientific regard for industrial working conditions. As a matter of fact the industrial era is much older than is generally supposed. Factories were operated by ancient peoples. Hammurabi, first King of Babylon, 2000 B.C., organized factories for the manufacture of goods for export at Omossos, and the Kings of Judah had at Kirvath Sephr weaving and dyeing factories, wine pressing mills, etc. Although much slave labor was used in ancient days for such work, it was not all slave labor, and was ruled by standards set by kings and rulers. Syrian capitalists at the time of the Crusades operated silk mills in the East.

Smaller work places preceded factories and for centuries (about 1100 A.D. to 1700 A.D.) the *Guilds* throughout Europe operated such 'factories' or 'shops' as they were called, many of such Guild shops being fairly sizeable. Conditions in such primitive 'factories' were notoriously bad, the 'apprentices' working almost as slaves, and sometimes chained to benches or whipped. This situation prevailed fairly uniformly in the Middle Ages in England, France, and Italy, conditions in the Italian Republics particularly encouraging them. In the later centuries of the Guild era capitalists set up shops or factories outside the towns to avoid the rigid regulations of the Guilds. Soon (in the time of Queen Elizabeth) merchandizing became more elaborate and the scope of operation wider; the Guilds thereupon losing power. The national governments then attempted to control them, as for example the English Acts of 1531 and 1536, and similar acts in France by Colbert in 1671. The famous Statute of Artificers issued in 1563 by Queen Elizabeth aimed at a fair standard of skilled labor, both in town and village. This regulatory tendency, including state operation and promotion of industry, was later pushed forward to such an extent that a reaction followed against State authority in industry. The repealing of the Acts regulating the woolen industry in 1809, and other repeals of Acts in 1813, 1814 and 1815 establishing this principle for a long time, setting up modern capitalism firmly.

As the industrial age began to use power and thus operate larger mills by steam engines the entire previous medieval status was within a decade changed radically, giving employers unregulated power over the lives of a great many men, women and children who worked within the crowded factory walls under conditions usually very bad for safety, health, morals and decency. A new cycle of industrial reform then became necessary within twenty years in England in order to halt the 'steam mill mad' factory owners in their inhuman exploitation of workers.

It took however three quarters of a century or more for factory workers in civilized countries to reach a status which could be called humane, and there are even today many islands of backwardness here and there. The famous Factory Acts in England (1833) first concerned themselves with protection of children and juveniles, and a continuing series of Acts affected hours and working conditions. Since that time a series of changes have occurred in most countries, all toward the betterment of working conditions and the conservation of life and health. It is, however, an astonishing fact that not until 1911, for instance, in New Jersey was there a regulation to provide metal cans for combustible waste; not until 1912 that gas jets were required to be enclosed in globes or wire cages. It also may be regarded as astounding that not until 1933 was child labor abolished in the United States (and then incompletely). The United States also lagged far behind other nations in such matters as protection from disease in factories through inspection of hides and hair, etc. Industry's toll in accidents was always greater than the decimation of war, and it was not until 1877 that a state in America required the guarding of belts, gears, shafting, protection for hoistways and elevators and adequate fire egress. The passion of Bentham in England for substituting science for custom in such matters won not only England but the whole industrial world, and the question is today one largely of efficient administration, keeping up with changing conditions and vigilance against backward spots.

The International Labor Office has worked since 1919 toward world-wide reduction of work hours; its 1919 convention on the subject, calling for a maximum of 48-hour week, was ratified by only six countries. The world depression hastened the general movement to shorten hours of labor. Almost unanimously reduction of hours is being resorted to as a protection against unemployment. International effort as a whole toward labor advance has had a setback due to nationalism, but has not crippled its efforts. In 1928 a Standard Code of Industrial Hygiene was drafted as a guide to countries, and finally approved in 1933. As a result India in her new Factory Act, also China and Japan, have adopted modern factory standards in safety and hygiene, lighting, cleanliness, comfort and efficiency. Italy also in 1933 adopted a new Factory Act.

In regard to women in industry, the depression brought world-wide restrictions upon women in industry, as a means of alleviating unemployment

Factory Acts

among male family heads. Strong agitation on this point existed in 1934, even in Canada.

The International Labor Office also recommended in 1923 a complete set of principles and rules of factory inspection suggested as a guide for formulating Factory Acts. These called for impartial, trained men, with authority to visit and inspect premises at any hour of day or night, to question staffs, to issue orders for changes necessary to conformance with law.

The 1934 Conference on Labor Legislation in Washington set up a standard or model for industrial codes, containing these items: (1) proper lighting, ventilation, temperature, humidity, air space; (2) all harmful dusts, gases, fumes removed; (3) personal protective devices, and protective clothing; (4) adequate safeguards on dangerous machinery; (5) fire safeguards, escapes, exits; (6) suitable seats with backs; (7) proper rest rooms, wash rooms, dressing rooms, conveniences, toilet, hot water; (8) suitable places for eating, cool water, fountains or cups; (9) periodic inspection by properly trained and qualified men and women; (10) reports required of all industrial accidents; (11) compulsory compensation by commission for all individual injury (accident or diseases arising from employment); (12) state insurance; (13) no work by women between 10 P.M. and 6 A.M.; (13) no child labor under 16.

England.—Lancashire, the cotton mill region, was the storm centre of reform in factory conditions over a century ago, testimony taken in 1796 disclosing intolerable conditions. The first Factory Act was passed in 1802 (Health and Morals of Apprentices Act), limiting apprentices' hours of work to 12 per day, abolishing night work, compelling separation of the sexes in sleeping quarters for apprentices, and other humane, health and educational provisions. Despite further reform efforts it was not until 1819 that child labor *under 9 years of age* was prohibited, while 12 hours a day was set as a limit for juvenile workers under 16, and no work between 8 P.M. and 5 A.M. The Factory Act of 1833 (amended in 1844) provided for inspectors and extended child labor laws to include women. The guarding of dangerous machinery, prohibition of cleaning machinery while moving, prohibition of 'wet spinning,' the damp of which endangered health, were the 1844 additions to the Act.

To understand accurately the horrifying conditions surrounding the early English factory, we must realize that between 1793 and 1815 England trebled her exports, the ending of war and the arrival of British sea supremacy, and the development of steam power uniting to bring about very sudden and enormous trade expansion, particularly in cotton goods. In 1775 England was using only 5 million lbs. of cotton, but this rose to 54 million lbs. by 1801, to 137 millions by 1821, to 273 millions by 1831, and 775 millions by 1849. Lancashire rose from 166,200 population in 1700 to 672,000 a century later, and then within 30 years (by 1831) more than doubled its population. Such mushroom industrial growth, in an economy just recently freed from all collective restraints, and with no large-scale precedents of humane responsibility, was virtually certain to be cruel to workers.

In 1848 ten hours a day for women and juveniles was set as a limit, and during the next 20 years the reform laws were extended to other industries. In 1864 the principle of protecting only the weak was widened; the term factory was made to mean 'any place where persons work for hire.' In 1867 the Workshop Regulation Act applied factory laws to all employment places on a basis of the number employed, and put upon local sanitary authorities the burden of administration. In 1878 all fifteen Factory Acts were consolidated and more efficiently administered centrally, but in 1891 the system of local sanitary administration was revived, and in 1901 this local system was further enlarged. In 1871, 1876 and in 1893 legislation strengthening the trade unions was passed, and in 1875 strikes were regulated, striking groups not indictable unless their acts were such as prohibited to individuals. The Conciliation Act of 1896 was for settling industrial disputes. The Trade Disputes Act of 1906 freed unions from liability for torts, ending the 'conspiracy' rule. In 1908 the Coal Mines Regulation Act for the first time in England regulated by statute the hours of work (8 hours). The Workmen's Compensation Act of 1897, followed by revisions in 1909 and 1911, arranged for employment exchanges, trade boards, minimum wages, health insurance, and old age pensions.

During the World War the Munitions Acts set up minimum wages, compulsory arbitration, increased workmen's compensation, and strengthened the trade boards. After the war the minimum wage provisions were broadened. In 1924 agricultural wage boards were set up with minimum wages in agriculture. Then followed a striking series of acts favoring labor, including salaried workers; strengthening administrative machinery, widening the scope of social insurance and extending unemployment insurance to all industry. In 1929 the Industrial Diseases Compensation Act consolidated laws and set up 28 compensable diseases.

A century after the first factory inspection the chief inspector reported (1932) that the English standard of factory conditions was in advance of or equal to any country in the world, but admitted that hours of work provisions of the Factory Act were obsolete. The Women, Young Persons and Children's Act of 1920 provided for two shifts for juveniles and women between the hours of 6 A.M. and 10 P.M. This was increasingly used, also the plan of short rest pauses of 10 to 15 minutes (and without diminution of output).

Trade unions in England demanded reductions to 40 or 36 hours per week; the Trades Union Congress General Council in 1933 definitely stating its aim as being a 40-hour week.

United States.—Small factories began to operate in America in 1787, but when in 1789 the tariff system began, factories rapidly multiplied. The first power loom began operation in 1814. Due to plenty of free opportunity in America, very little oppression of factory labor occurred. Workers had to be encouraged to stay in the mill instead of going 'west.' Nor did American workers, as in England, resist the coming of machinery. Labor organization was also slow to come, as wages and working conditions from the start were uniformly better. Hours were long, however, during America's industrial beginning—12 to 16 per day; even at the mill at Lowell, where conditions were called 'ideal' by the visiting Harriet Martineau, employed girls 10 years old for 14 to 15 hours a day. Factories were poorly lighted and heated, gravely lacking in sanitation and safety.

Average hours of working weeks in 1840 was 70 hours for railway workers and 75 to 84 for textile workers. Forty years of agitation and labor organization then followed, with the result that by 1880 the 60-hour week arrived, although street railway labor worked 90 to 108 hours. By 1913 it had been reduced to 49 hours, and by 1925 to 47. The New Deal in 1933 made a radical thrust

Factory Acts

downward to 40 and under. The five-day week gained wide currency.

In regard to labor safety, American statistics of labor accidents were for a long time unreliable and almost non-existent, but the National Safety Council reported 18,858 fatal accidents for 1928. The industrial accident rate of America is twice as high as that of any other nation. Employers' liability laws enacted by a few states proved unsatisfactory to both sides, and in 1908 a Workmen's Compensation Act was passed, and after New York's successful defense of its law in 1913 other states followed suit rapidly; 44 states, also Alaska, Hawaii, the Philippines and Porto Rico, had such legislation by 1933—although four states did not—Mississippi, South Carolina, Florida, Arkansas. In 17 of these laws are compulsory, the rest elective; but in 31 jurisdictions the employer not electing to use the facilities is denied the common law defenses.

Women have always been active in American work. The percentage of all women gainfully employed in 1890 was 18.9%, and by 1930 this had grown to 24.8%. So early as 1847 a ten-hour day law for women was passed in New Hampshire and Massachusetts. In 1934 only 4 states had no such legislation; 16 states prohibited night work, and 18 states required rest facilities for women workers. In 28 states legislation prohibited women in 37 prescribed dangerous occupations, while 6 states prohibited work near childbirth.

In 1884 New York enacted a law against tenement cigar factories, which when declared unconstitutional was followed in 1892 by a law requiring home industry licensing, and this in 1913 was revised to prohibit altogether certain types of home manufacture, notably food. Massachusetts in 1891 also enacted a tenement industry law, and 14 states in 1934 had such laws.

Child labor did not cease in the United States until the New Deal in 1933. In 1920 it had been reported that the 15 States with the poorest school attendance were also the States with the largest proportions of children of 10 to 13 employed. America's first cotton mill (Samuel Slater's) was largely operated by boys and girls of 7 to 12. In 1832 two-fifths of cotton operatives in New England were 7 to 16. Connecticut in 1813 required proprietors employing children to educate them, and in 1836 Massachusetts permitted only those under 12 to work who also attended school for 3 months. Modern child labor laws began with Illinois in 1903, which allowed no more than 8 hours' work for those under 16. Twelve states still permitted over 8 hours of work for juveniles until New Deal codes intervened, while 43 states prohibited night work for children. In 44 legislatures 153 child labor laws were introduced during 1929, showing strong feeling on the subject. Federal laws have been attempted twice, in 1916 and in 1918, both being declared unconstitutional. Then in 1924 a constitutional amendment was passed, but by early 1934 only 20 states had ratified it, and again its constitutionality was questioned.

Germany.—Bismarck, to placate advancing socialism, inaugurated in Germany a notable series of advanced laws governing the worker. Starting with his sickness insurance act in 1883, followed in 1884 by an accident insurance law and in 1889 by further social laws, (while at the same time restricting workers from organizing for economic or political purposes), Bismarck culminated this remarkable development toward state socialism with his famous Industrial Code of 1891. This provided for safety regulations, Sunday rest, no night work for women or children—while at the same time it legalized trade unions and set up machinery for settling labor disputes. As far back as 1824 there had been investigation of child labor, resulting in 1839 in a Prussian Children's Protective Act, prohibiting workers under 9 years of age, and limiting juveniles under 16 to 10 hours per day and no night work. Further acts were passed in 1845, 1849 and 1853 affecting workers; child labor in the latter year being restricted to 12 years; juveniles under 14 not to work more than 6 hours.

In 1867 modern Germany came into being, and a general industrial code was enacted in 1869; in 1878 health and safety measures were adopted, and in 1884 still more detailed provisions for safety. The Bismarckian industrial code of 1891 was amended and advanced frequently; (social insurance code, 1911) one of the more rare provisions calling for publicity for labor contracts. The German basic industrial code calls for modern standards of protection to life, limb and health, and for damages in case of default. Emphasis is placed on morality and separation of sexes. Child labor is restricted to 13 years, and from 13 to 14 only 6 hours per day, and only in non-dangerous industries.

In 1918, after the World War, a transitional period set in. Under the Federal Republic prôtection and improved conditions of employment were provided for in Articles 157 and 165. A Works Council plan was set up by acts of 1920 and 1922, giving workers greater control over working conditions. Under the Republic the trade union flourished and rule of industry labor conditions by unions resulted.

In 1933 came National Socialism (Nazi-ism) and with it a different philosophy of right-wing nationalism and fascism. In 1934 all the previous transitional industrial acts were abrogated and a system of regional labor trustees, in authority over industry, was set up. Employers were termed 'leaders' and employees 'followers'; with a 'confidential council' of executives and workers advising the leaders (in factories of 20 or more employees). These confidential councils were given the task of carrying out health and safety measures and other working conditions, although the basic industrial code was not disturbed. Dismissal regulations were set up, women in industry discouraged, and an attempt made to reduce hours of work from 48 to 40 per week. A completely 'new labor constitution' affecting hours of work, minimum wages, safety measures, child and female labor, home work, etc., was undertaken. This work was delayed in progress by internal Nazi dissension, the July 1934 uprisings and the emergency necessity for setting up an economic dictator with complete power.

Canada.—Organized into provinces like the States of the United States, Canada's labor legislation is likewise largely regional. Ontario passed the first Factories Act in 1884; Quebec 1885; Manitoba 1900; Nova Scotia 1901; New Brunswick 1905. Provisions for women and children were their features, all fairly uniform; 60 hours per week (Manitoba 54). The Industrial Disputes Investigation Act of 1907 adopted a policy half way between England's non-interference and Australia's compulsory arbitration—a period of time for investigation and recourse to arbitration.

In 1934, stimulated by the 'New Deal' of the United States, Canada adopted a five-year plan of social and economic reconstruction.

France.—A law in 1791 prohibited combination of workers for any purpose; this was not

modified until 1864. The first factory legislation began in 1841 limiting the work of children of 8 to 12 years to 8 hours a day, and that of juveniles 12 to 16 years to 12 hours. This admirable law, however (together with a general 10 and 12 hour day law passed in 1848), made no arrangements for enforcement, and both became dead letters. In 1883 a law for the enforcement of this shorter hour day was enacted, the duty being left to factory inspectors. After muddling along with this situation laws were passed in 1892–1893 raising the standards of hygiene and safety in factories, and new administrative edicts at various times since have continued to raise such standards. In 1900 amendments prohibited child labor under 13 (with special educational provisions for children of 12). Workmen's compensation laws for factories only were passed in 1898; later improved (1925).

During the World War minimum wages were set up, and in 1919 an 8-hour day for all was adopted without reducing pay, with joint representation with employers for fixing minimum wages. In 1928 a Social Insurance Law was passed, but later modified, and machinery set up for collective bargaining.

Australia and New Zealand.—These countries long held the record for the most advanced factory labor legislation. It first appeared in 1823 in New Zealand, limiting women and girls to 8 hours and providing for ventilation. Australia and New South Wales followed. In 1890 Australia set a world example of great influence when it introduced the first general 8-hour day, minimum wage laws and compulsory arbitration. It definitely left behind the theory still prevalent in most parts of the world that labor legislation should be only for the weak. Its laws were enacted for all groups. It set up machinery for fixing minimum wage standards for all in specific trades; arranged special boards for compulsory arbitration (in practice used only after all other efforts at conciliation had failed). Strikes decreased markedly under this regime. In 1904 a federal law on conciliation and arbitration made strikes and lockouts an offense if they went beyond the limits of a state. The average hours in 1934 in Australasia was 45, leadership in this respect going to America under the 'New Deal.'

Russia.—The Soviet revolution and its subsequent inauguration of the Five-Year Plan (1928–1932) resulted in a gigantic effort to change a backward agricultural nation into a modern industrial state through the agency of a regimented state capitalism and dictatorship. Three quarters of Russia's 165 million people are peasants and land-dwellers, whereas only 23 out of 100 people in America work on farms.

More than 1,500 new factories were built during the first Five-Year Plan; many of these hastily erected and roughly built; 33 blast furnaces and 63 open hearth furnaces were also built. Between 1928 and 1933 there were introduced 1,000,000 spindles for textile manufacture; 1,000 new saw-mill frames were added to the 1,700 existing. Between 1914 and 1933 the urban population rose from 25 to 39 millions, illustrating the speed of industrialization. In 1927–1928 there were 5,514,000 workers in the industrial, building, transportation and communications fields, and by 1930 this had risen to 7,584,000, at which point the free reserves of skilled labor became exhausted and a labor shortage existed. An alarming annual rate of labor turn-over (172.3% and higher) was experienced until December 1933, when the Commissariat for Labor decreed that refusals to accept work offered would be considered ungrounded with a few exceptions, and workers violating the provision would be demoted and food rationing limited or refused.

In spite of these and other difficulties Russia in the years 1928–1931 increased industrial production about 25% per year as against average yearly increases of about 6% in other large countries.

The first Central regulations for industry set up by the Soviet was in 1924, to remain in force until each establishment drew up its own additional regulations. For state industrial undertakings the new special regulations were adopted in 1927, when drunkenness and absenteeism increased and factory discipline proved inadequate under these regulations, they were withdrawn and a new set issued in 1929. In 1934 the Commissariat for Labor was abolished and the Central Trade Union Council set up as supreme in factory regulation and other matters. Regulations were of two kinds (1) general or central, (2) local, the latter representing agreement between the local management and the trade union concerned. It must be understood that in a proletariat economy as in Russia, where jobs are the worker's right, the problem of factory discipline rises to very considerable proportions, due to the greater vested interest and security felt by workers, and therefore lesser self-discipline. The 1929 regulations were definitely more strict in discipline, penalties being set up for refusal to work or carry out collective agreements, for damage, unjustifiable absence, idling, intoxication, bad workmanship or lack of common sense in handling materials, unruly conduct, forgery, sleep on the job, malingering, infringement of safety regulations.

The factory regulations (Section 50 of the Labor Code) called internal regulations, were composed of a combination of general or central factory legislation plus the agreements constituting local regulations, the factory inspector being vested with very considerable authority to approve of them or reject them and bring them into harmony with general central standards. These internal regulations covered:

(1) Hours of work: distribution of hours, working hours, rest periods, breaks, times of commencing and ending work, hours of attendance in the factory or undertaking, public holidays, annual holidays, arrangement of shifts, valid reasons for absence, etc.

(2) Use of instruments and tools, raw materials and the fittings of the factory (or establishment) in general: conditions under which tools are issued to the worker and must be returned, percentage of waste permitted, obligation for the worker to inform the management when raw materials or tools are of bad quality, etc.

(3) Hygienic and sanitary conditions and labor protective measures, accident prevention measures, and steps to be taken in case of fire or damage to machinery; workers' obligations as regards the hygienic and sanitary conditions of the workplaces; duties of the management with regard to hygienic and sanitary conditions (accommodation for meals, drinking water, etc.).

(4) Wages: days and hours for the issue of pay, method and period for returning account books to the management and withdrawing them, method and period for lodging complaints against irregularities in payment.

(5) Factory discipline: relationships between management and workers, conduct of workers in the factory towards comrades or the management, prohibition of alcoholic drinks and of games of chance not only during working hours, but also during breaks, meal times, etc.

During the first period of Communism (1918–1921) a compulsory labor plan was in operation. In 1922 the Labor Code, a compulsory contract of service was inaugurated, to which all workers and employers were liable; details to be determined by voluntary agreement. Account books were issued to workers to serve as records of service, payment of wages, etc. A worker exposed to bad treatment, or when factory hygienic conditions deteriorated, or he did not receive his pay, could terminate his contract. He could be dismissed for incapacity or other reasons until the joint committee of the factory had passed upon the matter. The management might appeal a decision to the labor court.

A standard minimum wage for all workers in a particular district was in force, but in 1929 increased rates of minimum wages were introduced for certain groups; but apart from this the State guaranteed a certain amount of remuneration. Workers also were guaranteed continuance of wages while doing other State duties for which they were called upon, such as witnesses, attending congresses and societies, etc. The State also guaranteed the payment of all wages and to protect him from claims made on wages. Wages during the early Communistic period were paid *in kind* to an increasing degree (86.2%) until about 1925.

Communistic principle demanded 'to each according to his need; from each according to his ability,' and at first uniform wages were paid; then 17 grades were established with a ratio of 5 to 1 between 17th and first grade. The problem of disparities due to extra pay and piece rates was continuous, the workers on piece rates enjoying larger pay. Standards of output were raised, and standard rates raised. It was constantly necessary to keep in mind the need for stimulation, the Five-Year Plans calling for a high rate of progress in production.

Thus was inaugurated 'Socialist competition' in the form of the 'shock troop workers,' of whom there were 3,563,100 in 1934, all receiving extra pay and extra rations. These shock troop workers were organized into opposing competitive teams, on the familiar lines of sales contests for salesmen in America.

Women workers in the Soviet were paid the same as men and given certain privileges, such as nursery care for children, full pay through childbirth, free medical attendance, etc.

All workers operated on a five day plan of four days' work and one day's rest; the process being continuous and days of rest staggered. Recreational facilities, health clinics and in some industrial centers special housing facilities were to be provided.

Consult Cheyney, *Industrial and Social History of England;* W. P. Reeve, *State Experiments in Australia and New Zealand* (1903); *Encyclopaedia of Social Sciences* (Vol. VIII); Bulletins U. S. Dept. of Labor; Bulletins International Labor Office; J. L. Hammond, *Rise of Modern Industry* (1926); Elizabeth L. Hutchin, *History of Factory Legislation* (1926); Henry A. Mess, *Factory Legislation and Its Administration* (1926).

Factory Organization and Management.—Industrial production from its beginnings represented higher organization because it enforced greater subdivision of labor and more elaborate forms of coöperation than was known in handcraft or guild days. The guilds also used business organization, but mainly an associational type of loose federation. When the Elizabethan period arrived and its rapid expansion of commerce and exploration, the need for a larger scale and more complex commercial organization came, and 'joint stock' companies were formed to pool the capital of a group of people. Such organizations as well as individually owned large-scale firms were obliged to learn how to delegate at least a certain degree of authority and responsibility to those at the head of various divisions of their enterprises; and the whole art and science of modern business organization (in particular manufacturing business organization) centers around this matter of successful delegation of authority and responsibility, in order to form an organization of many parts which function swiftly, effectively, harmoniously, making use of the largest possible measure of individual and collective ability.

Long delay and slow development in factory or business organization was occasioned by the limitations of outlook of the average *entrepreneur,* who invariably suffered a disinclination to delegate much authority, although he did not hesitate to exact responsibility. Such owners or operators are now understood to represent the 'Napoleonic' type of industrial organization, arrogating to themselves the most serious authority and hiring lesser calibre men who did little else but carry out orders. Thus the nearest to the owners or operators of large enterprises (up to about 1890) were almost invariably men of ability not at all comparable to the owner or operator, but only good order takers without much initiative. The owner or operator worked long hours and made virtually every decision of any consequence. He had no functional organization, only some 'managers' and 'assistants' and his inclination was to perpetuate his name and rule by nepotism.

It was Carnegie and Rockefeller who by their outstanding, dramatic success with the principle of real and full delegation of authority and responsibility, convinced the modern business world of the great superiority—even the necessity—of this principle in modern large-scale enterprise. Attention was at last focused upon the technics of organization, and the objective rather than the subjective attitude of owners and managers. The 'Napoleon complex' in management lost its prestige; the old personal rule of industrial geniuses and 'captains of industry' was seen to be inadequate for a more scientific age of large enterprise. The completion of great transportation systems opened from coast to coast the entire American market to manufacturers and inaugurated the mass production principle, ending the small local factory system. To operate such large manufacturing organizations was a task calling primarily for organization of many top-grade abilities. Carnegie and Rockefeller made it their cardinal principle to hire men of highest ability and give them clearly marked functional authority and responsibility to the fullest degree. Carnegie's partners and Rockefeller's associates made vital decisions unhindered by their chiefs; the new principle being to pay unusually careful attention to selecting executives, give them complete authority and hold them responsible for results. Thus the conception of the top executive changed from a man who made all decisions beyond minor ones, to a man whose chief duty was to set broad policies, select men, coördinate their activities and study results.

The merit system of promotion and the development of a functional organization for a manufacturing organization is of particular importance because manufacturing enterprise calls for a variety of special abilities —(1) understanding and purchase of raw materials, product research, technique of fabrication, personnel and labor relationship, accounting, securing of capital, financial management, research and development of markets, advertising, shipping, credit and export. In modern

Factory Organization

times these functions, as well as other subdivisions of them, have become specialized professions. No top-executive can be fully skilled in them all; he must deal with the primary factors of business organization, men, money, information, policies, coördination, general strategy. Thus business organization has adopted (as has modern military organization, after also dropping the Napoleonic personal tyrant form) the line-and-staff conception of functional organization with the stockholders comparable with the citizenry, the board of directors comparable with the cabinet, the president comparable with the commander in chief, and the general manager with the general; the research head as chief of staff and the department heads with division heads.

As in military organizations, so in business organization, *esprit de corps* is vital, because an organization will not cohere if its parts are loosely or indifferently welded. Thus modern business organization makes use of an organization chart, depicting diagrammatically how the organization is put together, the flow of authority and the relationship of its parts and functions. Such a chart first of all shapes the organization to its task, secondly demarcates with absolute clarity all authority and responsibility, and thirdly, visualizes the entire enterprise to each individual in it.

In the period 1910–1929 corporate business organization in the United States tended more and more toward centralization, the holding company being the final central apex of a continuously more complex structure. This was a device however more often used for financial than for technical strategy, and after 1929, when it was revealed how many holding companies obstructed rather than aided sound business, a strong tendency toward decentralization set in. This was a significant major turning point in American business organization method, for it reversed the flow of initiative and authority. Previously, due to extensive consolidation and centralized ownership or control, the unit heads of centralized enterprises tended to become 'order takers' rather than autonomous managers with fairly full authority and responsibilities. This, it was found, reduced general efficiency and profit. By 1932 widespread reversal to a decentralization policy occurred, and it appears to be a settled and proved business principle that each unit of business operation (no matter how large a whole it is part of) should be operated on a basis of maximum possible local authority and responsibility. This not only gives individual personality and initiative greater play but capitalizes local conditions and differences more accurately and fully. 'Robot' organization under 'one big head' is thus demonstrated to be unsound both humanistically and technically.

The form of factory organization has radically changed in fifty years for another reason—because of change in conception of function. This function was at one time conceived to be mainly *production*. Thus there were factories employing 200 or more workers operated with only two to five office people—perhaps the owner, an assistant, a bookkeeper, a stenographer and an office boy. In a 'production age' this was possible because the output was easily sold, perhaps to only one outlet. Today, in a 'distribution age' with competition far keener and factory organization far more complex, it requires a much greater ratio of office workers to factory help, despite the tendency of machinery to reduce labor.

The function of a factory organization is no longer mainly simple production. It does not first make goods and then undertake to sell. Its primary function in a distribution age is to *meet consumption demands*. It is only secondarily a production organization; the primary function being distribution; and this shifts the emphasis in factory organization from work bench to the office. To root itself firmly the factory organization must have some measure of control of its consumer prestige and distribution machinery, and this often means a whole series of new organization functions, such as consumer and product research, advertising, field sales organization, selling direct, ownership of retail and wholesale outlets or regional manufacturing or warehousing, sometimes even special transportion systems.

Next, the development of modern liberal labor principles and industrial psychology has made necessary new functions of factory organization, such as personnel, welfare, educational, recreational, social and employment work; while modern scientific management technique has also added new aspects and functions. Finally, the new trends toward group action in industry, profit-sharing, pension, trade association, collective bargaining, code and other coöperative effort under the 'New Deal' enlarged still further the activities which are encompassed within factory organization (which is nowadays more and more regarded as a quasi-public institution).

Business principles and policies are the fundamental reasons for the existence of an organization; there can be no true organization without them. There is a real difference between *policy* and *principles;* principle being set for permanence by top-executives; policy being set for expedient periods by the lesser executives. A business achieves its main individuality from its principles and policies. They motivate and steer the organization. Principles, sometimes called general policies, must deal with broader and deeper matters of ethics and general purpose and outlook, while policies must deal with the commoner technical factors and exigencies. To change principles is a dubious proceeding; to change policies is a frequent necessity.

Clear-cut policies about all matters of operation and procedure, even minor ones, is a mark of good organization; but these policies should be set with as high a degree of scientific objectivity as possible. That is to say, with the maximum of information and counsel. Decisions as to policy in past years were usually made by individual fiat or 'judgment,' whereas today among good organizations policies are set only after research. There is greater appreciation of the difference between fact and opinion, and less tendency to rate past experience very highly. 'Get the facts first' is the modern executive's order, and it is regarded as worth considerable research expenditure to assemble facts to serve as a basis of policy-making.

Manuals are often used, in association with organization charts, to make clear the organization's form, its purposes, its principles and policies, its standards, history, personnel, expectations, rules, privileges and opportunities. Such manuals are first-class material for establishing and maintaining *esprit de corps*. Lectures, house organs, social occasions and activities are also used. Work, salary and promotion quotas and standards, and competitive contests are also set up to stimulate, measure and reward competence. No one thing destroys business organization more rapidly than favoritism, internal politics, nepotism and the lack of the strict merit system. Suggestions from employees, employee councils and group meetings are alike important.

Organization etiquette is an important factor in sound business organization; that is to say, inter-departmental good will and

meticulous observance of certain rules of sound organization, such as avoidance by a superior of 'going over the head' of a subordinate, or transversely a subordinate taking action without authority, or a department head crossing the lines of his charted authority, out of his sphere. Balanced authority and smooth-flowing coöperation is the general goal.

Forms of organization vary widely. Railways use a number of vice presidents, each in charge of a division of activity; but in manufacturing organization this form is used only by the vertical or circular consolidations which have a variety of types of enterprises. Often, though, there is a vice president in charge of sales and one in charge of production; sometimes one in charge of finance. The general tendency in modern times is for the board of directors not actively to administrate the business, but to give full powers to the president and the vice presidents, with sometimes a chairman of the board watching over the management, without actually participating. In some organizations the president acts in this manner, while the active responsible head is the general manager. In other cases an executive committee of the directors, or one composed of active heads, acts as an intermediary between the board of directors and the management. Much criticism since 1929 has fallen upon banker-dominated boards of directors who operated the company from too strictly a financial point of view. The technical executives are now rated more highly in management, and presidents of companies who were either too narrowly financial, or too production-minded (in this distinctly distribution age) have been discredited in favor of consumption-minded top executives, who understand markets (the primary consideration in modern manufacturing organization).

Large-scale versus small organization in manufacturing may be said to have counterbalancing values, but with the greatest advantage on the side of large-scale production in lines where adequate capital and modern equipment count most and service least. Harvard University researches (1934) indicated that large-scale manufacturing made more consistently satisfactory profit than smaller organizations. The progress of manufacturing organization has been from small shop to large, then to horizontal consolidation, operating a series of plants; then to vertical consolidation, operating a series of related enterprises, such as growing, mining or processing of raw materials; then to circular consolidation, manufacturing and selling a group of unrelated products, distributed through the same channels; then triangular consolidation, manufacturing, wholesaling and retailing (this last one not yet proved in efficiency). The 1929–1934 depression tested business organization severely, particularly demonstrating the weakness of highly centralized group organizations put together for financial rather than technical advantage. It also demonstrated that the superior position of small business organization, in its proper sphere where volume, large capital and fractional profit margins and standardization are not important factors, but where good will, service, individuality, low overhead and swift adaptation count. There appears to be ample room for both developments side by side.

Considerations in starting new factory organizations cover such research of existing field for proposed product; analysis of competition, price levels, costs, profits, research of consumer and distributor attitudes, technical and competitive tests of proposed article; study of trade-mark or patent situation; study of raw material status and prospects; study of plant location from angles of raw materials, labor, distribution cost; budgetary plan for five years of operation; study of capital needs, capital structure best suited; analysis of manufacturing process, machinery; study of unit costs on volume production ratios; study of proposed prices, discounts, margins, analysis of sales and advertising cost, merchandising methods, packaging; layout of functional organization; study of available personnel; blue print or schedule of five-year plan and procedure; detail of policies and principles.

Specific factory organization, in the sense of production solely, starts with the research of the product, chemically or mechanically or both; then goes on from there to purchase and storage of raw materials, the routing of the processes of manufacture on a continuous line basis, mechanization of processes, power plant, consultation with designers of special machinery, designing or remodeling of factory buildings to fit, location of skilled labor, negotiation with unions, arrangements for supervision and inspection, special counsel on power or scientific management on motion study, tuning up, setting of standards of work, and maintenance of morale.

Factory building ideas were radically changed in the period 1914–1934. The use of directly applied electric motors, the continuous-line process, motion study, modern lighting ideas (which tend toward windowless factories, air-conditioned and artificially lighted), and the vastly increased use of high-speed tools and automatic machinery, have produced changes almost as great as the turn from water power to steam. Studies in 1934 indicated that about 60% of industrial factory buildings were obsolete. Greatly improved efficiency in almost any type of manufacture is possible by the use of the newest ideas of factory building and process. This is due to greatly increased labor costs which make the use of human hands more costly than ever, while at the same time modern automatic machinery design has achieved new heights.

Material handling had reached very unusual lengths of development, due to need for elimination of human labor. Special electric trucks and cranes, plant trolley systems, the use of shutes and gravity feed, and the teaming up processes, machinery, building arrangements, railway unloading machinery, moving belts, elevating apparatus, pumps, tractor hauled cars, pipe pressure systems, and all manner of ingenious devices are being made use of in manufacture to eliminate handling. In many instances the entire process became automatic from the first movement of raw material to the packing of the finished product. Factory organization and management is thus in large part concerned with cutting unit costs, both of manufacturing process and of handling. In a large plant general systematization of routine and mechanization of supply for workers is of utmost importance, because a fractional difference repeated thousands of times makes a worth-while total per day. A skilled workman should be using his skill, a large part of the time, not his mere muscles for material handling which an unskilled worker or a conveyor could do for him. This is the principle in motion study which Taylor, Gantt, and Gilbreth so eminently developed. There must be distinguished here carefully the difference between the 'speeding up' to which labor unions object, and the competent bringing and taking away of materials from a skilled worker, in order that he may really use his skill. Competent handling of materials for him actually lightens his load. Industrial strain on workers by 'speeding up' is not sought by good factory management. What is desired is simply greater intelligence and work-

Courtesy Albert Kahn, Inc., Architects and Engineers

INTERIOR OF FORD ENGINEERING BUILDING, DEARBORN, MICHIGAN

Modern factory design makes for increased efficiency. In this giant room, floor space and natural illumination are at a maximum.

Courtesy Albert Kahn, Inc., Architects and Engineers

Photo by Multi-Color, Detroit

ASSEMBLY PLANT OF GENERAL MOTORS AT LINDEN, NEW JERSEY

Huge structures such as this permit the concentration of essential industrial processes. In this plant the walls serve as windows.

Factory Organization

planning as a result of group skill and a coördination of mechanics and brains. No one thing brought general costs of consumers goods down so decidedly as modern mechanical material handling, from the dumping of an entire carload of coal by machinery to the straight-line moving belt in standardized manufacture.

Factory inter-communication was done in olden days by messengers and speaking tubes, whistles or shouts, later by telephones. In 1934 the progress was more striking, short-wave radio sets being used for communication between separated plants, also the teletypewriter, by means of which an order written on a typewriter in a concern's New York sales office may (by leased telephone wires) be transcribed automatically on another typewriter in any one selected (or all), the plants of the company, wherever located, ten or a thousand miles away. The short-wave radio telephone communication does away with need for stringing wires, and the teletypewriter does away with delay in getting an order entered, and also decreases the chances of error, because of a single transcription.

Calls for foremen, workers or executives in large plants are now made (as in department stores) by means of an electric code signalling system, audible in any part of the plant; each man having a code signal assigned to him. The telautograph system, transmitting the sender's handwriting is also used; also the dictograph system which makes the sender's voice audible throughout a room. Pneumatic tube systems, carrier belts and the ordinary telephone are also in use. Messengers on roller skates are sometimes employed.

Plant layout is regarded as vital to an efficient factory. As process control (separating and grouping similar processes) was widely adopted, transportation from one division to another became a problem, and planning, routing, scheduling and dispatching became vital. This led to a new principle, product control, equipment for a particular product being set up in sequence with as little transporting as possible. In large mass production it took the form of 'straight-line production,' but in smaller plants the principle was also economical, even in inventory control. Combination of several cycles of operations, shutes between operations, grouping work and equipment are used. By making 'process charts' and 'flow charts' of parts and operations, measuring distances traveled, making tests for new layout, securing practical suggestions of workers, a new plant layout may be devised of as much as 40% greater efficiency; in one instance 35% reduction of distance traveled, 11% reduction in floor space, 44% reduction in floor area for parts storage, 20% reduction in time of unit manufacture. In these days of individual motor-driven equipment rearrangement is not difficult. Startling reductions in manufacturing interval are being achieved by change from process to product control. A factory operation is made up of three parts: (1) *make ready,* (2) *do,* (3) *put away.* While high speed tools and automatic machinery have greatly improved the second item, plant layout is now looked to for the new savings in make ready and put away.

Preparation of Order is a vital part of good factory organization, since the order is often complex and must be dealt with efficiently. To eradicate human error, an order should be made out once, adequate for all purposes, on a master form (with a special ink which permits ready duplication by hectograph or zinc dupligraph, or simply a series of unit forms made on a typewriter, using carbon paper). These unit forms may at one operation cover all forms needed from original order to notice of shipment, including 10 to 20 different forms for different purposes and processes involved in recording and filling the order.

When many operations are involved and many duplicated copies are needed for various departments and workers the hectograph copies are made on different colors of paper, such as (1) white dispatch order for central planning or contributing departments, (2) green index copy, (3) brown material withdrawal copy, (4) goldenrod raw materials available copy, (5) canary finished stock delivery copy, (6) pink production copy, (7) salmon accumulation notice, (8) blue revision copy (for cancellation or 'hold-ups'), and so forth.

Identification tags or stickers made from the original order form are used to attach to small pieces, castings, parts, etc. A shop record and cost card is sent to each factory station having an operation to perform, and when the order is completed these are all assembled. Time vouchers are also made up in duplicate sets, for payroll, load deduction and the operator. The handling of repeat order forms in plants where they are numerous is done by mechanical equipment, factory forms being made from zincograph plates, kept on file for use when orders are repeated.

Production planning is intelligent scheduling of all operations, without which production control is impossible. A 'production schedule' must show (1) dates, drawings or technical instructions required, (2) dates raw materials are required, (3) dates component parts must be finished, (4) main assembly, testing and shipping dates. Representatives of departments in consultation agree on the dates. Copies of the schedule are posted or supplied to foremen, production men, departments. Routing and pricing is done by the planner, and standard and special operations, extra work operations, set-ups are noted as separate items. Daily engineering bulletins go to the chief planner, and necessary changes are made on the master planning card. The 'dispatch station' is a modern method widely used in up-to-date production planning. It is a wire-enclosed cage manned by one or two men, and serving units of from 50 to 100 workers, each 'dispatch station' placed in the midst of the plant division it serves. The station serves as an active outpost for the production planning centre and systematically works in close relation with factory operatives.

Inspection is the task of certifying that the finished article is up to specifications. There are intermediary inspections and final inspections. When an inspector rejects a product, it is, in some systems, at once 'blue-tagged' and segregated, and either a spoilage deduction voucher or inspector's report made out. Good systems of inspection make for quick turnover of defective materials, places responsibility, checks losses, keeps clerical work at minimum, and prevents customer ill will. Alert, adequate inspection systems are an integral part of modern production technique.

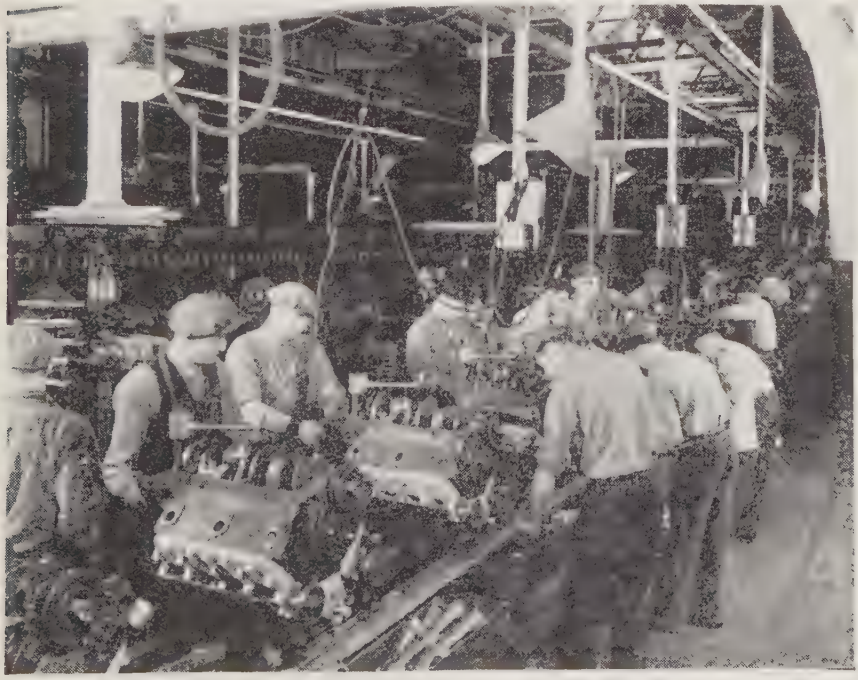
Stock Control is a specific function for conservation and care of raw materials, parts and supplies, and is usually under the administration of a rigid system. Such systems include (1) main office central control, (2) territorial or branch or subsidiary control, (3) local or individual plant control. The stock control technique includes inspection of materials coming in, care and accurate classification (usually in vertical wire bins), complete records in detail and periodic inventory. Its functions are as follows:

1. Furnish material and supplies when and where needed.

2. Inspect and check goods received and report promptly all receipts with description of condition, etc.

ASSEMBLING PARTS OF AUTOMOBILE MOTORS

This scene shows the portion of the plant in which pistons, connecting rods, wrist pins, and crankshaft bearings are assembled.



Photos courtesy Ford Motor Co.

ASSEMBLING MOTORS IN AN AUTOMOBILE PLANT

Work in a well-organized factory is swift and sure. The engines shown in this picture are well along toward the end of the assembly line.

Factory Organization

3. Record all goods received and dispatched in such way that the amount on hand may be estimated at a glance (records kept in this way serve as a perpetual inventory).

4. Maintain vigilance over stock and issue none save on proper authority.

5. Establish a maximum and minimum stock mark and hold stock within those limits.

6. Place requisitions for reorder with the purchasing executive far enough ahead to insure judicious purchasing and receipt of goods before stock on hand is exhausted.

7. Maintain standards established by standardization plans by seeing that the correct name and description of all material for re-order are furnished fully to the purchasing executive.

Modern science of inventory control, in the effort to keep inventories at lowest practical point, calls for alert management and watchfulness.

Purchasing is a major industrial science and a specialized profession; emerging from a haphazard exercise of the purchasing function of the past. Today the scientific view prevails, and purchase by guesswork, favor or 'pull,' or high pressure salesmanship is disappearing. Instead, purchasing agents have their own codes and professional ethics, national and local associations and coöperative committees, and operate laboratories where not only are purchases tested, but new specifications worked out for goods to be purchased. In some instances firms unable to purchase goods of the qualifications desired have put their own experts into the factories of supply companies, or even organized or financed factories to make the goods as per specification. A purchasing agent must not only buy what is offered, but sometimes also stimulate the seller to make goods.

Purchasing must distinguish between sellers as to their standing, experience and likelihood of continued service and ability to deliver. There is a difference between a *reliable* and a *dependable* source of supply; the reliable one being one competent to produce the right quantity and quality; the dependable one being the firm not only equipped for quantity and quality, but in addition able and willing to make any sacrifices to deliver without fail. The purchasing department must be in close touch with knowledge of all important sources and study all changes going on. If it must buy basic commodities which are subject to world or general market fluctuations and volume of supply (such as wool, cotton, silk, vegetable oils, etc.) it must study crop and other conditions which affect prices, and be 'market wise.' While speculation in raw materials as a policy for factory executives is now generally condemned, the speculative element is ever present in such commodities. Long-range prognostication is often necessary. General price tendencies on a short or long term basis need to be studied, since price levels have definite long term swings, up or down.

A purchasing department needs for its guidance in making efficient purchases the following information:

1. Full specifications as to quantity, quality, and intended use of materials requisitioned.

2. Advance information as to curtailment or expansion of production.

3. Changes in specifications, even though these changes do not have a direct bearing upon the materials purchased.

4. Date of receipt and condition in which goods are received.

5. Maximum and minimum limits of storage spaces.

6. Amount received, requisitioned and on hand in storeroom.

7. Rate of production.

8. Rate of sales.

9. Cost of production and selling.

10. Selling price and gross or net profit.

11. Overhead expense of entire organization.

12. Financial standing and resources.

13. Specific duties and responsibilities of each department, and the relation of these departments to purchasing.

Large purchasers often use the 'blanket' order, covering any desired length of time and any quantity, at an agreed-upon price or the market price, or a sliding quantity scale. Under the 1934 'New Deal' code conditions, price factors have been very difficult to adjust, as for example the NRA requirement for uniform prices by firms in the same industry, and the provision for 15% variation for government contracts, such variations to become code standards for all buyers.

Knowledge of the laws of contract are also vital to purchasing science; rights and liabilities of contracting parties; when and how contracts may be cancelled or the seller forced to live up to it, etc.

Industrial purchasing falls into classifications, such as (1) contract buying, (2) buying direct, (3) buying from jobbers, (4) buying through brokers, (5) buying from salesmen, (6) buying by mail through samples, (7) buying on open market, (8) buying through exchanges, (9) buying through competitive bids.

'Standardization' is a purchasing term used to designate the installation of equipment all of one type or make, to facilitate and simplify repair, supply and operation. It also usually involves concession on the part of the seller. Standardization is a term also more widely used, such as standardization of catalog sizes, or other forms, policies, plans. Standard order system, invoices, purchasing orders are used.

Testing is a part of purchasing technique, and large concerns operate extensive laboratories for the purpose. Tests may be for purity, pliability, absorption, content, tensile-strength, measurement, etc. The tests may be physical, chemical or general. Sampling tests are conducted on a basis of the law of averages, a certain random number being selected from each shipment or package.

Employment Management. —The entire range of labor relationships is here involved, and is an increasingly crucial element in factory management. The New Deal of 1934, reducing hours, setting wage minimums and enforcing collective bargaining as a principle, brought the subject of labor relationships to a new focus. Severe strikes, even at the model plant and model village of the Kohler plant, in 1934, indicated that labor relations were in a new phase, and employment management a more critical art and science, as a result of modern liberal tendencies, and also as a result of the 1929–1934 depression, when a peak of 14,000,000 unemployed was experienced.

Employment and personnel management have become a profession and science. In a factory like Henry Ford's a department of many people is maintained, not alone to 'hire and fire,' but to study home conditions, housing, budgets, welfare and make sociological researches. In a plant like the Endicott Shoe Company, there is a technique of social recreation, housing, welfare, health service, education and many other forms of service aiming at happy relations with workers. Since 1918 a general change in point of view has come about; a realization that philanthropical welfare work is a subtle form of pauperization; that the best principle is to secure more self-help on an equality basis, and aim at wage increases, collective bargaining and a greater degree of participation by labor in decisions affecting workers' welfare and fortunes. A general

tendency toward decentralizing industry is taking place; *i.e.*, to scatter factories into suburbs and small towns. Henry Ford aimed at coördination between farm and industry.

Employment departments of today acknowledge greater responsibility in hiring and laying off help, using questionnaires and detailed study to fit the worker to the job and induct him into it properly. They make work tests and set up specific employment standards for certain types of work. They set up machinery for supervision which will be fair, and work out principles of work councils, employee participation, grievance committees, etc.

Some very unusual developments have taken place since 1930 in employee relations and in coöperation between unions and management. While some such coöperation has been known (as in the typographical unions), it has in such instances been forced by unions (the chapels, supreme in shop management). The modern union-management coöperation is best exemplified in the Baltimore & Ohio railway shops, the 'B & O plan' which began in 1923. Management and employees pledged themselves to reduce operating costs by economies, new methods and improved processes; the reward being stabilization and extension of annual period of regular work. Local, divisional and general joint committees of management and men operate this. Its results have been markedly successful. Six other railways had by 1934 adopted this plan. The Procter & Gamble Company set up a plan whereby it guaranteed year-round employment to workers of a certain status. The A. Nash Co. of Cincinnati, Ohio, in 1926 set up in their clothing plant a complete industrial democracy, in which workers participated both in management decisions and in profits, even after the shop was unionized. The Dennison Co. the Mitten-Mahon plan in Philadelphia and Columbia Conserve Co., Indianapolis, and others worked out democratization plans, in whole or in part; while thousands of plants have developed Works Council plans, some adjusting wages according to living cost indexes and sharing economies with employees.

Since the 'New Deal' labor's status has taken on new importance, on the theory of consumer purchasing power as a decisive factor in prosperity. In England this development was in the ascendancy for ten years before, as a result of the rise of the Labor party and post-war depression. Such employers as Lever Bros., Rountree, Cadbury, etc., had long taken the lead in a liberal employee relations, especially in housing, working conditions, etc., although England's world free trade competitive position until 1931 prevented her from going as far as America in hours and wages.

Employment departments keep detailed records about workers, make tests, check records, instruct workers, rate wages, make contracts, hear complaints, conduct special studies, develop employment statistics.

Administration.—There are normally four main business organization functions: (1) Market Study and Marketing; (2) Administration; (3) Finance; (4) Production. These functions were formerly said to be production, administration, sales; but modern industrial knowledge rearranged them; consumption and markets come first; next, men to administer; next, money; next, production, ordered to fit market and finance. Administration is a coördinative task, calling for functional departments presided over by executives of special training, complete authority, and these woven together coördinatively by general executives whose task is to visualize the problems of the enterprise as a whole. Certain administrative types of work are common to all divisions such as stenographic service, record-making and keeping, research, cost accounting, legal, traffic, filing, correspondence, accounting, etc., and these are linked into one department in many efficient organizations for the benefit of mass handling. In this way they too have become professionalized, as for example office management, financial management, traffic; these opening up opportunities as separate professions. Thus as business has grown in size it has magnified into a specialty certain types of work which had not been concentrated upon before; hence making possible, as in all specialties, interchange of experience.

Administration, to be successful, must (1) clarify its general goals and visualize them vividly, (2) set performance standards to attain these goals within specific time limits and specific cost, (3) select men competent to lead the departmental effort necessary to accomplish results; (4) offer incentives sufficient to call out the best in such men, (5) back them up fully, and coördinate all effort smoothly, (6) arrange for flow of money and credit, raw materials and supplies sufficient to meet demands, (7) instill a strong general *esprit de corps*, (8) be prepared to revise policy and plan to fit conditions as they arise, (9) protect and enhance the general name and good will of the concern, (10) keep alert and open-minded for suggestions and ideas from any source.

Research is a powerful arm of modern administration; its basis being the modern desire to base decisions upon solid fact rather than judgment, experience or guesswork. This refers especially to business research as contrasted with product research. General executives in modern times are humble instead of arrogant in opinion, realizing the very limited nature of one man's experience or judgment, and the superiority of field study, research, statistics, law of averages, analyses.

Outside Counsel has also enormously grown in use and value since 1914, as it became recognized that specialized knowledge had expanded to such a degree that even department heads could not be expected to be experts in all divisions of their field. Thus production engineers, power experts, motion study specialists, factory layout experts, efficiency engineers, etc., have been of great aid to factory production. In the same way sales counsellors, advertising counsellors and outside market research firms, sales coaches, etc., have aided sales departments. In administrative departments budgetary experts, tax experts, bankers, expert cost and general accountants, office efficiency experts, etc., have aided in holding down unit costs of administration and made available the pooled experience and technique of many companies.

Consult E. H. Schell, *Technique of Executive Control* (1932); Scott-Clothier-Mathewson, *Personnel Management* (1931); Lowry-Maynard Stegemerten, *Time and Motion Study* (1933); J. George Frederick, *Business Research and Statistics* (1926); W. J. McDonald, *Handbook of Business Administration* (1926); P. M. Atkins, *Factory Management* (1931).

Faculæ ('little torches'), so called by Father Schenier of Ingolstadt, who noticed them about 1612 as bright streaks and patches on the sun's surface. They rise from the photosphere (q. v.) and show conspicuously near its margin. Some of them extend 20,000 miles in length, and their duration is sufficient for determinations by their means of the sun's rotation.

Faculty. In the educational sense, faculty originally designated one of the chief divisions of university instruction—theology,

law, medicine, and philosophy. The term is also applied to the teaching body of a college or other educational institution, and in this sense is usually confined to the teachers of professional rank. In American colleges the functions of the faculty have in recent years been broadened to include powers of recommendation and appointment to collegiate positions as well as of internal administration. In the present university organization each grand division has its own faculty, ordinarily represented by delegates to a general body representative of the institution at large.

In English ecclesiastical law a faculty is a license, dispensation or permission. The statute of 25 H. VIII. c. 21, which prohibited all applications to the pope for dispensations, licenses, etc., gav power to the Archbishop of Canterbury to grant them. His court is called the Court of Faculties, and the head of it is the Master of the Faculties. It is situated at 23 Knightrider Street, Doctors' Commons, London. This court grants special licenses to marry, and faculties to ordain a deacon under the age of twenty-three, or to hold two livings at once, or to act as a notary public. Faculties are also granted by the Consistory Court of the bishop of the diocese for many other purposes, such as the removal of dead bodies, the alteration of churches or parsonages, the erection of monuments, or the introduction of new ornaments or furniture. See Phillimore's *Ecclesiastical Law* (1895).

The term is also used in Scotland to designate the Society of Advocates of Court of Session, and of legal practitioners forming incorporated bodies. In England the word is not used in this sense.

Fadeyev. See NEW SIBERIA ISLANDS.

Faed, JOHN (1819–1902), Scottish artist, was born at Burley Mill, Kirkcudbrightshire. In 1841 he went to Edinburgh, and for eight years practised there as a miniature painter, after which he settled in London. Among his chief works are *Shakespeare and his Contemporaries, The Cottar's Saturday Night, The Soldier's Return, The Morning after Flodden, An Incident of Scottish Justice.*

Faed, THOMAS (1826–1900), Scottish painter, brother of John Faed, was born at Burley Mill, Kirkcudbrightshire; studied at the Art School, Edinburgh, and in 1849 was elected Associate of the Royal Scottish Academy. In 1852 he settled in London, and began to exhibit regularly at the Royal Academy, of which he was elected associate in 1859 and full member 1864. Out of sympathy with the conventional sentimentality of the day, he relied upon his own observation, and strove after a simple fidelity to nature. His themes are taken from Scottish peasant life, and his sincere tenderness of feeling and conscientious workmanship soon brought him wide popularity. Among his most celebrated pictures are *The Mitherless Bairn, The First Break in the Family, Faults on Both Sides* (Tate Gallery), *In Time of War* (Liverpool), and *Annie's Tryst* (Edinburgh). See the *Magazine of Art* (October, 1900).

Faenza, tn. and episc. see prov. Ravenna, Italy, 31 m. by rail S.E. of Bologna; famous in the 15th and 16th centuries and at present for its pottery (whence *faïence*) and majolica. The town has a 15th century cathedral containing many works of art, and a fine art gallery. It also manufactures silk. Pop. 39,757.

Fæsulæ. See FIESOLE.

Fagotto. See BASSOON.

Faguet, EMILE (1847–1916), French literary historian, born at La Roche-sur-Yon; from 1897 professor at the University of Paris, and from 1900 member of the French Academy. He was one of the most learned and brilliant of modern French literary critics. His works embrace studies on the great French writers of the 16th–19th centuries (1885, 1887, 1890, 1894); monographs on Voltaire (1894), Flaubert (1899), and Zola (1903); *Histoire de la Littérature Française* (1900), etc.

Fagus. See BEECH.

Fahlun. See FALUN.

Fahrenheit, GABRIEL DANIEL (1686–1736), German physicist and scientific instrument-maker, born at Danzig; studied under Gravesande, the Dutch mathematician and friend of Newton, and finally settled at Amsterdam. He invented an areometer, substituted mercury for alcohol in the tubes of thermometers, and devised the thermometric scale (freezing-point, 32°; boiling-point, 212°) still used popularly and by meteorologists in England, Holland, and the United States. He was elected a fellow of the Royal Society of London in 1724.

Faidherbe, LOUIS LÉON CÉSAR (1818–89), French general, born at Lille. He took part in expeditions in Algeria and the W. Indies, and went to Senegal in 1852, being made governor in 1854. After the fall of Napoleon III. he was summoned by the government of the National Defence to France, and (1870) appointed commander-in-chief of the Northern Army, but was defeated near St. Quentin (1871). He was then sent to Egypt to study the archæological remains. He was the author of *Collection des Inscriptions Numidiques* (1870), *Épigraphie Phénicienne* (1873), *Le Soudan Français* (1884), etc. See *Life*, in French, by Fulcrand (1890), and by Brunel (ed. 1897).

Faïence, or FAYENCE, a name loosely applied to several kinds of pottery ware. See POTTERY.

Failsworth, urban dist., Newton Heath, 4 m. N.E. of Manchester, Lancashire, England, with cotton-spinning, silk-weaving, and manufacture of hats. Pop. 16,000.

Fainting, or SYNCOPE, is a form of insensibility due to a temporary anæmia of the brain. It is specially apt to occur after exhaustion arising from over-exertion, wasting disease, fasting, bad air, loss of blood, or any similar cause. Some faint at the sight of blood or from the scratch of a vaccinator's needle. Startling or distressing news may produce a fainting-fit, especially in those who are weak. Frequently recurring fainting-fits point to serious heart weakness.

Treatment.—Tight clothing should be loosened, and the patient should be laid flat, with the feet higher than the head, to encourage sufficient flow of blood to the brain. If the amount of blood in the body be insufficient through hæmorrhage, it may be economized by temporary firm bandaging of the arms and legs, from fingers and toes upward, so that the blood is pressed out of the limbs, and kept to serve the vital parts for the time. Hæmorrhage is also treated by the injection of warm saline solution (roughly a teaspoonful of common salt to a pint of water) into a vein, or preferably, because more easily, under loose skin or into the bowel, whence it is rapidly absorbed. Fresh air, a dash of cold water on the face, inhalation of stimulants such as alcohol, ether, or ammonia, complete rest, and freedom from excitement soon bring complete recovery from an ordinary fainting fit.

Faioum. See FAYUM.

Fair. A fair is a market, but it is held less frequently. It generally extends over a longer continuous period, and is of a more miscellaneous character than a market. Every fair was originally a holiday or saint's festival, which, owing to the concourse of people, was utilized by the itinerant trade. In many cases the commercial aspect has now completely disappeared, the name in Britain being frequently appropriated for an annual local holiday —*e.g.* Glasgow Fair. The security guaranteed to the merchant, not only while the fair lasted, but also while he was journeying to or from it, was a very useful supplement to the law of the land. In some districts there

Fair

was a regular succession of fairs, which thus practically guaranteed, all the year rou d, freedom and security of transit. In France, in the Champagne country, there were in the 12th century six fairs—Provins, Troyes, etc.—extending over the whole year, and the money used at these fairs was a kind of international currency; hence Troy weights. The importance of fairs diminished in England after the time of Edward I. One of the most famous of English fairs was that of Stourbridge, near Cambridge, of which

An Old English Fair: 'Southwark Fair.' By Hogarth.

descriptions are given by Defoe and Thorbold Rogers. The fair was opened on September 8, and lasted for three weeks; and during this time the ordinary judicial and other officers were put aside in favor of the officials of the owners of the fair, and the court of Pie Powder (*i.e. pieds poudrés*—dusty feet—that is, travelling merchants) had supreme jurisdiction in the fair. Another great English fair was that of St. Bartholomew, held at Smithfield, London, until 1855. The great fairs at Leipzig, where leather, cloth, and furs are sold, at Frankfort, and at Nijni-Novgorod are the best known in modern Europe; but others of importance are or were held at Beaucaire in France, Irbit in Russia, Pesth in Hungary, and Bergamo in Italy. The fair of Nijni-Novgorod retains most of its importance, and attracts traders from all parts of the Russian empire, and during its height spreads itself over an area of seven square miles. The fairs of Siberia are still of great importance, and at Kiakhta a large proportion of the commerce between China and the Russian empire is transacted. In the U. S. the fair as a market does not exist; but it has been adopted in some places as a kind of minor exhibition either in connection with an agricultural or live-stock exhibition or a local industrial exhibition. The county fair usually includes horse-racing and other sports, and in many cases the original agricultural side of the exhibition is more or less lost sight of.

Fair, JAMES GRAHAM (1831–94), American 'bonanza king,' was born near Belfast, Ireland, and was brought to America in 1843 by his parents, who settled in Geneva, Ill. James received a good education there and in Chicago, where he made a specialty of chemistry. He was one of the first to cross the plains to California in 1849, and among the earliest to abandon placer mining for underground work, in which his knowledge and judgment of minerals gave him a great advantage. On the discovery of the Comstock Lode in Virginia City, Nev., he removed to that place, and in 1867 organized a combine with Mackay, Flood, and William T. O'Brien, the four eventually gaining control of the principal silver mines in that vicinity and clearing up over $100,000,000 in the process. Mr. Fair was elected U. S. senator from Nevada in 1881. He established, with his partners, the Nevada Bank, but withdrew from all business in 1886. Afterward it became necessary for him to come to the rescue of his former partners, who had attempted to manipulate a wheat corner. The renewed business activities incumbent on

the settlement of these matters injured his health, and he died in San Francisco in 1894.

Fairbairn, ANDREW MARTIN (1838–1912), Scotch divine and author, born near Edinburgh. From 1860–72 he was minister of the Bathgate Congregational Church. Thence he removed to Aberdeen, where he held a similar post until 1877, when he became principal of Airedale College. He was Muir lecturer at Edinburgh University (1878-82), Gifford lecturer at Aberdeen (1892–4), and he delivered lectures on the Lyman Beecher foundation, at Yale Divinity School, from 1891 to 1892. He was also principal of Mansfield College, Oxford, to which he was appointed in 1886, and one of the constituent fellows of the British Academy. His principal works are *Studies in the Philosophy of Religion and History* (1876), *Studies in the Life of Christ* (9th ed. 1896), *The City of God* (1882), *Christ in the Centuries* (1893), *The Place of Christ in Modern Theology* (1893), *Philosophy of the Christian Religion* (1902).

Fairbairn, SIR WILLIAM (1789–1874), Scottish civil engineer, born at Kelso, Roxburghshire, began business at Manchester (1817), introducing several important mechanical improvements, especially the substitution of iron for wood in the shafting of cotton mills. He was the first in England to build an iron ship and was invited by the British Association to investigate the causes of certain supposed defects in iron produced by hot-blast furnaces, submitting a valuable report on the subject. With Robert Stephenson he designed the great tubular bridge across the Menai Strait, and was one of the founders of the British Association for the Advancement of Science, of which he was president in 1861. He was the author of many works on engineering matters, including *Mills and Mill Work* (4th ed. 1878); *Iron: its History and Manufacture* (3d ed. 1869); *Iron Shipbuilding* (1865). See his *Life*, edited by W. Pole (1877).

Fairbanks, CHARLES WARREN (1852-1918), American politician, born in Union co., O., educated at the Ohio Wesleyan University (1872) and admitted to the Ohio bar. He was chairman of the Republican State Convention in 1892, and U. S. Senator from Indiana, 1897–1904. In 1898 he was a member of the British-American Joint High Commission. From 1904 to 1908 he was Vice-President of the United States. He then went on an extensive foreign tour.

Fairbanks, THADDEUS (1796-1886), American inventor and manufacturer, was born at Brimfield, Mass., and early removed to St. Johnsbury, Vt., where his brother and he established a business for manufacturing cast-iron ploughs and stoves. Thaddeus was granted his first patent for an improved platform scale in 1831, and this was followed by about fifty others, covering all varieties of weighing machines, the firm devoting themselves to their manufacture thereafter. Mr. Fairbanks was a liberal benefactor of local institutions.

Fairbury. (1.) City, Neb., co. seat of Jefferson co., 52 m. S.S.W. of Lincoln, on the Little Blue R., and on the Chi., Rock I. and Pac., the Chi., Burl. and Quin. and the St. Joe and Grand I. R. Rs. The chief manufactures are flour and iron articles. There are also machine shops, creameries and nurseries. There is a public library. Fairbury was settled in 1870. Pop. 5,294. (2.) City, Livingston co., Ill., 90 m. S.W. by S. of Chicago, on the Tol., Peor. and W. and the Wabash R. Rs. It is situated in the Illinois corn belt. Coal is mined in the vicinity, and there are grain elevators and manufactures of cement blocks, sorghum molasses, and corn flour. Fairbury possesses the Dominy Memorial Library. Pop. 2,505.

Fairchild, CHARLES STEBBINS (1842–1924), American lawyer, born at Cazenovia, N. Y., graduated at Harvard in 1863 and at the Law School in 1865. He practised law in Albany, and later removed to N. Y. City. He was attorney-general of N. Y. in 1866–7, secretary of the U. S. Treasury in 1887–9 and a member of the Indianapolis Monetary Commission of 1897. From 1889 to 1905 he was president of the New York Security and Trust Company.

Fairchild, GEORGE THOMPSON (1838–1901), American educator, was born at Brownhelm, O., and graduated (1862) at Oberlin College, taking his degree in divinity at the theological school in 1865. He was professor of English literature at Michigan Agricultural College from 1865 to 1879, and president of the Kansas Agricultural College from 1879 to 1897, in the following year becoming vice-president and professor of English literature in Berea College, Ky. Dr. Fairchild has held office in educational associations. He published *Rural Wealth and Welfare* (1900).

Fairchild, JAMES HARRIS (1817–1902), American clergyman and educator, was born at Stockbridge, Mass., and graduated (1838) at Oberlin College, where he was a tutor from 1838 to 1842, being meanwhile (1841) ordained to the Congregational ministry. He continued as a professor at Oberlin, giving instruction in various subjects until 1866, when he accepted the presidency of the college, which office he held till 1889. In 1898 he accepted the Finney professorship of theology in the theological school. Dr. Fairchild published *Moral Philosophy* (1869) and edited Elder Finney's *Memoirs* (1876).

Fairchild, LUCIUS (1831–96), American soldier, born at Kent, O. In 1861 he entered the volunteer service as a captain in the First Wisconsin Infantry. He commanded the 'Iron Brigade' at Bull Run, and was severely wounded at Gettysburg. He rose to the rank of lieutenant-colonel in the regular service and brigadier-general of volunteers, and resigned Nov. 2, 1863. He was governor of Wisconsin in 1866–72, consul at Liverpool in 1872–8, consul-general at Paris 1878–80, and minister to Spain in 1880–2.

Fairfax, ALBERT KIRBY, 12th Baron Fairfax of Cameron in the peerage of Scotland (1870), born in Prince George co., Md.; son of John Coutee Fairfax, M.D. (1830–1900); became a banker in New York and London. He was the first of the American Fairfaxes to formally lay claim to the peerage (dating from 1627), and in 1908 the Committee on Privileges of the House of Lords upheld his right to the rank and title of Lord Fairfax of Cameron.

Fairfax, THOMAS, LORD (1612–71), English parliamentary general in the civil war, was born at Denton in Yorkshire. During the restless times of Charles I. he was one of the most prominent military leaders in the north. He recaptured Leeds (1643), and assisted Cromwell in his victory at Winceby (1643) and at Marston Moor (1644), and was then appointed by the House of Commons to be commander-in-chief, and entrusted with the reorganization of the army (1645). He defeated Charles I. at Naseby in the same year, and approved of the trial and deposition of Charles, but tried to prevent his execution. At the Restoration he was one of those who proceeded to The Hague to invite Charles to assume the crown; but, disgusted with the riot and immorality of the court, he withdrew to his estates. See his *Memorials*, his *Psalms* and poems; also Markham's *Life of Fairfax* (1870), with a list of pamphlets relating to his campaigns; and *The Fairfax Correspondence* (4 vols., 1848–49).

Fairfax, THOMAS, sixth Baron Fairfax of Cameron in the peerage of Scotland (1692–1782), was born in England of ancient lineage. His father married the daughter of Lord Culpeper and came into

possession of great estates in Virginia. Upon succeeding to these estates, Thomas sent his younger brother, Sir William, to Virginia, and followed himself in 1639. He again went to America in 1745, supposedly on account of a disappointment in love, and remained there until his death, building a manor house near Winchester, Va. Sir William's daughter married Lawrence Washington, brother of George Washington, and Lord Fairfax took young George into his employ as a surveyor, thus beginning a lifelong friendship. Lord Fairfax remained a Loyalist, and after his death the Virginia estates were forfeited. The title to the peerage, descending by a collateral line, has been continuously recognized by the British House of Lords, but was not assumed until the succession (1908) of the twelfth baron, Albert Kirby Fairfax.

Fairfield, town, Connecticut, in Fairfield County, on Long Island Sound, and on the New York, New Haven and Hartford Railroad; 4 miles west of Bridgeport. It has an excellent beach and is a popular summer resort. Features of interest are the Fairfield Memorial and Pequot libraries. Manufactures include rubber, paper, aluminum, drugs, and perfumery. It was settled in 1639. The place was taken and burned by Governor Tryon, July 6, 1779. Pop. (1910) 6,134; (1920) 11,475.

Fairfield, city, Illinois, county seat of Wayne County, on the Baltimore and Ohio and the Southern Railroads; 103 miles east of St. Louis, Mo. The manufactures include athletic underwear and lumber; and grain, poultry, fruit, cattle, hogs, and lumber are shipped. It was settled in 1819. Pop. (1910) 2,479; (1920) 2,754.

Fairfield, city, Iowa, county seat of Jefferson County, on the Chicago, Burlington and Quincy, and the Chicago, Rock Island and Pacific Railroads; 48 miles northwest of Burlington. It is situated in a fertile agricultural region, which has deposits of coal and tracts of timber. The chief manufactures are wagons, agricultural implements, washing machines, malleable iron, and brushes. It is the seat of Parsons College (Presb.) and has a Carnegie Library. It was settled in 1837. Pop. (1910) 4,970; (1920) 5,948; (1925) 6,333.

Fairfield, village, Maine, in Somerset County, on the Kennebec River and on the Maine Central Railroad; 21 miles northeast of Augusta. The manufactures include pulp, and woollen goods. The town has a free library. Pop. (1910) 2,801; (1920) 2,747.

Fairhaven, town, Massachusetts, in Bristol County, on the Acushnet River, and on the New York, New Haven and Hartford Railroad; opposite New Bedford, with which it is connected by ferry and bridges. It has a good harbor and extensive fishing interests, and there are manufactures of iron goods, nails, tacks, loom cranks, and glass. There are also shipyards, and the town is a popular summer resort. Pop. (1910) 5,122; (1920) 7,291.

Fair Haven, town, Vermont, in Rutland County, on the Delaware and Hudson Railroad; 16 miles west of Rutland. Slate quarrying is the principal industry. Pop. (1910) 2,554; (1920) 2,540.

Fair Head, or BENMORE HEAD, promontory on the northern coast of County Antrim, Ireland, east of Ballycastle Bay, about 640 feet high.

Fairies, popularly conceived to be delicate little beings, of almost microscopic size, more or less human in shape, and with gauzy wings. On the other hand Shakespeare's Falstaff is made to believe that well grown youths and maidens are fairies. Elemental spirits can hardly be dissociated from fairies, in many of their aspects and yet the fairies of popular belief are often derivable from real personages, indistinctly remembered in tradition. Thus, Queen Mab, depicted as an ethereal little creature, has her original in a certain Medhb, queen of a tribe or confederacy in early Ireland. Oberon, again, is traceable, through mediæval French Auberon or Aulberon, to the dwarf Albe-rich, who eventually became the court buffoon of Dietrich of Bern. It is probable that the vast mass of European fairy traditions dates from the early days of the struggles between Celts or Teutons and the small dark race which preceded them, and that the imaginary fairies owe their diminutive size to exaggerated tales of the short stature of those Euskarian aborigines.

Modern research points out that there is supposed to be a strong infusion of fairy blood in the people of Guernsey, who have an old tradition that their island was once invaded by fairies, who fought a bloody battle with the natives, killed or enslaved all the men, and married the women. The common recognition of the Gaelic term *daoine-sithe* (lit. 'mound-people') as equivalent to 'fairies' results in an identification of these people with the Picts, to whom the former name appears to have been applied by the Gaels in allusion to their earth-covered and underground abodes. In short, there are many indications that the stories relating to fairies are, for the most part, derived from the intercourse between European races of average height and a much smaller dwarf people—an intercourse similar to that between the Kaffir tribes of South Africa and their precursors, the Vaalpens and Bushmen, or between the taller races of Central Africa and their pygmy neighbors.

Some of the accounts of fairies suggest, however, that they were possessed of a culture superior to that of their neighbors, and certain writers are inclined to regard the gypsies as the originals of the fairies, this assumption being based on the hypothesis of Bataillard, De Mortillet, and others, that the gypsies introduced bronze into Europe long before the days of Roman ascendency. It is pointed out that gypsies and fairies have many characteristics in common, each constituting a 'secret commonwealth,' with laws and language of their own, each accredited with prophetic power and with special knowledge in certain crafts, and each accused of the practice of child-stealing. The Peak Cavern in Derbyshire is alike remembered as 'one of the entrances into Fairyland,' and as a famous rendezvous of gypsies in past centuries. Again, in a Scottish witchcraft trial of 1588, it is stated that a certain native of the town of Stirling had been carried off by a gypsy, and was now 'with the fairies.' The extensive literature of this obscure subject includes Campbell's *Popular Tales of the West Highlands;* Croker's *Fairy Legends of Ireland;* Rhys' *Celtic Folklore;* O'Grady's *Silva Gadelica;* MacRitchie's *Testimony of Tradition,* and his *Fians, Fairies, and Picts;* Jacobs' *English Fairy Tales,* and his *Celtic Fairy Tales;* Hartland's *Science of Fairy Tales;* Craigie's *Scandinavian Folklore* Kennedy's *Legendary Fictions of the Irish Celts;* Mawer's *Roumanian Fairy Tales;* Naaké's *Slavonic Fairy Tales;* Stokes' *Indian Fairy Tales;* Littlewood's *The Fairies—Here and How* (1914); Yearsley's *The Folklore of Fairy-Tale* (1924); Faulkner's *Tales of Many Folk* (1926); Frère's *Fairy Tales from India* (1926). See also DWARFS, ELF, GNOME, GOBLIN, PUCK.

Fair Isle, island, Scotland, between Orkney and Shetland, 29 miles southwest of Sumburgh Head. It is 3 miles long, by 2 miles broad, is rocky, and rises to a height of 480 feet. It is famous for its hand-knit hosiery. Pop. about 200.

Fairlie, village, Scotland, in Ayreshire, 2½ miles south of Largs. It is celebrated for

yacht building. Among the yachts built here by the Fifes were the *Valkyries* and the *Shamrocks I., II., and III.*, competitors in the America Cup races (1899–1903).

Fairmont, town, Minnesota, county seat of Martin County, on the Chicago and Northwestern, the Chicago, Milwaukee and St. Paul, and the Chicago, St. Paul, Minneapolis and Omaha Railroads; 44 miles southwest of Mankato. It has a foundry, cement factory, cigar factory, creameries and flour mills, and is a shipping point for grain and livestock. Pop. (1910) 2,958; (1920) 4,632.

Fairmont, city, West Virginia, county seat of Marion County, on the Monongahela River at the head of navigation, and on the Baltimore and Ohio, and the Monongahela Railroads; 77 miles southeast of Wheeling. The State Normal school, Miner's Hospital (State), City Hospital, and Cook's Hospital are situated here. The principal manufactures are machinery, coal by-products, cigars, sheet aluminum and glassware. It is the shipping point for the county's extensive production of timber, coal, and coke. Fairmont was settled in 1758. The population according to the 1940 census was 23,035.

Fairmount, town, Indiana, in Grant County, on the Cleveland, Cincinnati, Chicago and St. Louis, and the Pennsylvania Railroads; 60 miles northeast of Indianapolis. It is the seat of Fairmount Academy (Friends). Manufactures include lumber, plate paper products, flour, and tools. There are also natural gas and oil industries and a branch of the Snider Canning Plant. Fairmount was settled in 1827 and incorporated in 1870. Pop. (1910) 2,506; (1920) 2,155.

Fairmount College, known since 1926 as the University of Wichita, a co-educational institution under Congregational control at Wichita, Kansas, founded in 1892 as a preparatory school, reorganized as a college in 1895 and again reorganized in 1926. It comprises four colleges, *viz.* Liberal Arts, Business Administration and Industry, Education, and Fine Arts. It confers the degree of A.B. in accordance with the requirements of the North Central Association of which it is a member. Property vested in Fairmount College was transferred to the Board of Regents of the Municipal University. A specially endowed Department of Religion is maintained by funds donated to Fairmount College and transferred as a trust fund for the purpose to the University. For recent statistics see Table under the heading COLLEGE.

Fair Oaks, railway station, Virginia, on the Southern Railway, 7 miles northeast of Richmond. The battle fought here May 31–June 1, 1862, is better known as Seven Pines (q.v.).

Fair Oaks, BATTLE OF. See SEVEN PINES, BATTLE OF.

Fairport, village, New York, in Monroe County, on the New York Central, and the West Shore Railroads; 10 miles southeast of Rochester. Manufactures include lumber, carriages, baking powder, baking soda, 'certo', flour, canned goods, and sanitary cans. Pop. (1910) 3,112; (1920) 4,626.

Fairweather, CAPE, on the southeastern coast of Alaska, about 300 miles southeast of Prince William Sound.

Fairweather, MOUNT, peak, over 15,000 feet, Alaska, in the Saint Elias range, 20 miles northeast of Cape Fairweather.

Fairy Rings, circles in lawns or pastures of either more luxuriant growth than the surrounding grass, or else almost bare of grassy growth. They were formerly supposed to be the marks of fairy dances, but are really due to the presence of a little fungus, the oread or fairy-ring champignon (*Marasmius oreades*), the spores of which fall every year outside the ring on which the champignon has grown, until the fungus dies out. The oread is one of the best edible fungi. It is of a creamy yellow color throughout; its gills are broad, and each distinct; its stem is slender and solid; and it is possessed of a strong, aromatic scent. It is important to remember that its stem is quite naked, while that of a relative and frequent neighbor, the stinger, is downy at the base.

Faisans, fā-zäṅ', ILE DES, or ILE DE LA CONFÉRENCE, small island in the Bidassoa, near Irun, between France and Spain. Here, in September, 1659, the Treaty of the Pyrenees was concluded between France and Spain.

Faith, a fundamental element in the religious consciousness, and one which fills a supreme place in Christian life and doctrine. With God or Christ for its object, as often in the gospels and in the Pauline epistles, faith comes to signify a personal heartfelt conviction of, associated with humble self-surrender to, the divine. Soon, however, we note a change in the significance of the term. Thus, in Jude (verse 3) it appears to stand for a body of Christian doctrine, and the Epistle of James (ii. 14) suggests that an even less spiritual use of it was early in vogue. In point of fact, faith has always been prone to fall back to its original meaning of intellectual assent. In the Middle Ages it was generally regarded as mere mental acceptance of the Christian dogmas on the authority of the church; and its correlative term revelation, in place of signifying a personal communication of divine truth to the individual soul, was interpreted to mean the authoritative delivery of a body of doctrine. It should be observed, however, that while this intellectual assent was regarded as essential to salvation, it was not regarded as of itself securing it; hence the necessity of works as the complement of faith.

Luther and the reformers, disagreeing with the church's teaching about works, strove to recover the original evangelical conception of faith—*i.e.* the warm personal adhesion to God in Christ; and, laying this at the foundation of the Christian life, they promulgated the characteristic Reformation doctrine —justification by God's grace through faith alone. Faith, however, must also be regarded as the assent to the authoritative teaching of the church; and the fact that the revelation of divine truth is made only to faith, has led to much discussion as to the true relation between it and ordinary scientific knowledge. One of the most striking solutions is that of Albrecht Ritschl, who, following up the suggestions of Schleiermacher and Kant, distinguishes between judgments of fact (*Seinsurtheile*) and judgments of value (*Werthurtheile*) —*i.e.* between affirmations regarding things in their objective-scientific relations, and those that indicate the *worth* or *value* of things for the individual. The latter are asserted to be the judgments of faith, which thus have nothing to do with the proof of historical or scientific facts as such, but which lie at the basis of all religion, and form the subject matter of Christian theology in particular. Consult James' *The Will to Believe;* Bright's *The Law of Faith;* Gordon's *Ultimate Conceptions of Faith;* Hall's *Relations of Faith and Life;* Inge's *Faith and Its Psychology.*

Faithfull, EMILY (1835–95), English philanthropist, was born in Surrey. She devoted herself to the cause of workingwomen and in 1860 founded a printing office in London where women compositors were employed. Her enterprise attracted the interest of Queen Victoria, who made her Queen's printer in ordinary. In 1863 she founded the *Victoria Magazine*, to advocate the claims of women to remunerative employment. She published *Change upon Change* (1868), a novel, and made lecturing tours in the United States.

Faith-healing, the doctrine

which holds that sickness may be cured without medical aid, by the prayers of believers, and the experience of true faith on the part of the sufferer. The belief is chiefly based on James v. 14.

Faith-healing doctrines have been popular in Sweden, England, and the United States. The supposed miraculous cures at Lourdes in France, and at Sainte Anne de Beaupré near Quebec, are famous, and similar cases are reported to have occurred repeatedly from the earliest times.

The Emmanuel Movement, which was started in Boston in 1906, is a good example of faith-healing. Its object is to bring into effective co-operation the physician, the psychologically trained clergyman, and the trained social worker in the alleviation and arrest of certain disorders of the nervous system which are now generally considered to involve some weakness of character or more or less complete mental dissociation. No effort is made to cure organic disease, and the work of the members is confined strictly to the religious and psychological aspects of the problem of functional disorders. See also CHRISTIAN SCIENCE; PSYCHOTHERAPY. Consult Cutten's *Three Thousand Years of Mental Healing;* Worcester and McComb's *The Christian Religion as a Healing Power* and *Religion and Medicine.*

Faium. See FAYUM.

Faizabad, fī-za-bād′, or FYZABAD, chief town of Faizabad district, United Provinces, India, is situated on the left bank of the Gogra River, on the site of the ancient city of Oudh (q. v.); 75 miles east of Lucknow. It contains the mausoleum of the Bahu Begani, the finest one in the province, and the mausoleum of Shujaud-daula. Sugar refining and agricultural pursuits are carried on. Pop. about 62,000.

Faizabad, capital of the Afghan province of Badakhshan, Central Asia, is situated on the Kokcha River, a tributary of the Amu Daria; 180 miles northeast of Kabul. It is noted for its rubies. Pop. 2,500.

Faizpur, fīz′pōor, town, Khandesh district, Bombay, India, 100 miles south of Indore. Cotton prints and dyes are manufactured. Pop. 10,000.

Fajardo, fä-här′do, town, Porto Rico, is situated on the river of the same name near the northeast coast of the island. It is well built with wood, stone, and brick, has three Catholic churches, a Protestant mission, a hospital, and a number of schools. Sugar, molasses, and tortoise shell are exported. Pop. 6,086.

Fakirs, fā kīrz′, Mohammedan and Hindu religious mendicants or ascetics. See DERVISHES.

Falaise, fä-lez′, town, department of Calvados, France, is situated on the river Ante, 20 miles southeast of Caen, on a rocky hill on which stands the castle in which William the Conqueror was born (1024). The town has cotton and yarn mills and copper foundries, and its suburb, Guibray, is the seat of an important horse-fair (August 10–25). Pop. 6,847

Falashas, fälä′shäz, Hamitic tribe of Abyssinia, supposed to be descended from Jewish immigrants of the time of Solomon. A conquering people in the middle ages, they are now hard working and peaceful, living in scattered communities, practising Jewish rites, and speaking a dialect akin to the Agau.

Falb, RUDOLF (1838–1903), Austrian meteorologist was born in Obdach, Styria, and settled (1888) in Berlin. He travelled extensively spending three years, 1877–1880, in North and South America, and published his views—on earthquakes, storms, and other terrestrial phenomena—in many volumes, but meteorologists never accepted these quite seriously. His works include *Ueber Erdbeben* (1895), and *Kritische Tage* (1895).

Falcon, fô′k'n or fôl′k'n, a name applied in general to birds

Falcon.

of prey of the sub-family Falconinæ, of the order Falconidæ. The most typical member of this family is the Peregrine or Duck-hawk (*Falco peregrinus*), which is widely distributed. It is slaty-gray in color, with dark markings on the head and neck and white under parts, banded with black. The beak is notched and very strong, the tibia longer than the metatarsus, and the cere, legs, and toes, yellow. The wings are long and powerful. The nests are built generally on ledges or cliffs, occasionally in trees, and the eggs, two to four in number, are cream-colored with red blotches. The food consists of pigeons, ducks, partridges, grouse and rabbits. The bird is remarkable for its courage and its devotion to its young, which both parents will defend at all costs. The peregrine is the bird most commonly chosen in modern revivals of Falconry (q.v.).

Other American falcons include the gerfalcon, goshawk, and pigeon-hawk (qq. v.). Among European falcons are the merlin, hobby and kestrel (qq. v.).

Falcon, fal kōn′, state of Venezuela, South America, lies on both sides of the Gulf of Maracaibo and along the coast of the Caribbean Sea. The soil is fertile, and coffee, cocoa, sugar, cotton, and tobacco are grown. The area is 36,212 square miles. The capital is Coro. Pop. (1936) 215,140.

Falcone, fäl-ko′nā, AMELLO (1600–65), Italian painter, was born in Naples, was a pupil of Jusepe de Ribera (Il Spagnoletto), and started an academy of his own. At the time of the revolt of Masaniello (1647) he formed his pupils into a secret band for retaliation on the Spaniards, but later had to flee, first to Rome, and then to France, where he was employed by Louis XIV. and Colbert. He is especially famous for his battle pieces. They are supremely true to nature, and are brilliant in coloring. Of his numerous pupils, Salvator Rosa was the most distinguished.

Falconer, fô′k'n-er or fôl′k'n-er, HUGH (1808–65), Scottish botanist and palæontologist, was born in Forres, Elginshire. He was educated at the University of Aberdeen and the University of Edinburgh, went to India as assistant-surgeon in the service of the East India Company (1830), and between 1831 and 1834 made remarkable discoveries of fossil mammalia, reptiles, and fishes in the Sewalik Hills. He was appointed superintendent of the Saharanpur botanic garden (1832), and of the Calcutta botanic garden (1847). The successful introduction of tea-growing into India was mainly due to his efforts. He returned to England in 1855. A selection of his papers, entitled *Palæontological Memoirs and Notes,* with a biographical sketch, was published in 1868.

Falconer, SIR ROBERT ALEXANDER (1867), Canadian educator and man of letters, was born in Charlottetown, Prince Edward Island, and was educated

at Queen's Royal College, Trinidad, and at the Universities of London, Edinburgh, Leipzig, Berlin, and Marburg. From 1892 to 1895 he was lecturer in New Testament Exegesis at the Presbyterian College, Halifax; from 1895 to 1904 professor and from 1904 to 1907 principal. He became president of Toronto University in 1907; was created K.C.M.G. by King George in 1917; and has received honorary degrees from British, American, and Canadian universities. He is the author of *The Truth of the Apostolic Gospel* (1904), *The German Tragedy and its Meaning for Canada* (1915), *Idealism in National Character* (1920), and of many articles in American and British encyclopædias and periodicals. He is an eloquent and convincing speaker. He is Canadian editor of Nelson's Perpetual Loose-Leaf Encyclopædia.

Falconer, WILLIAM (1732–69), Scottish poet, was born in Edinburgh. He went to sea as a boy, later entered the navy, and was drowned when the frigate *Aurora* went down near Cape Town. His nautical career prompted his *Universal Marine Dictionary* (1769), and his remarkable poem of *The Shipwreck* (1762), founded on his own early experience. Consult biographical introductions to *The Shipwreck*, by J. S. Clarke (1804), and by Alexander Chalmers in *English Poets*, vol. XIV (1810).

Falconio, făl-kō′ni-ō, DIOMEDE (1842–1917), Italian Roman Catholic prelate, was born in Pescocostanzo, Italy, and entered the Franciscan order in 1860. He was sent to the United States as a missionary in 1865, and was ordained a priest in the following year, holding educational and administrative positions in the United States and Newfoundland until 1883, when he returned to Italy. Here he filled high ecclesiastical offices, and was consecrated bishop in 1892, was made archbishop in 1895, and cardinal in 1911. He was Apostolic Delegate to Canada (1899–1902), and to the United States (1902–11).

Falconry, the art of taking game by means of trained falcons and hawks, is believed to have been known in China some four thousand years ago. It was early practiced in other Eastern countries and in continental Europe, and in England was the chief sport of the aristocracy from the days of Alfred to those of James I. In France it flourished down to the reign of Louis XIII.

Of late years the taste for falconry has manifestly increased in Great Britain. It is practiced in Holland and France and to some extent in America.

The birds employed by falconers belong to two classes—the long-winged, dark-eyed falcons, and the short-winged, yellow-eyed hawks. To the former class belong the jer-falcons, peregrine, lanner, saker, Barbary falcon, the Indian Shahin, the hobby, and the merlin; to the latter the goshawk and sparrow-hawk. The former take their prey by rising above it in the air, and *stooping* at it from a considerable height, and striking it to the ground; the latter pursue in a straight line, and, overtaking the quarry by superior speed, clutch it, and come down with it.

Hawks are either taken young from the nest before they can fly, when they are termed *eyesses*, or are caught later, during the period of their migration, by means of a decoy-pigeon and a bow-net, when they are called *passage-hawks*. A passage-hawk on being caught is hooded, and has jesses, or soft leather straps, fastened on her legs. She is then set down on a block of turf to prevent damage to feathers, and fed once a day, at first through the opening of the hood, afterwards with the hood removed. The bird is always fed upon the gloved hand, and gradually learns to step on to it from the perch, increasing the distance daily until she is obliged to fly to reach the fist. The training then commences. The hawk is *called off*, as it is termed, *to the lure*, which means that after tying a long line to the ends of the jesses she is held hooded on the hand of an assistant, until the falconer at the distance of 25 yards swings the lure to which the bird has been accustomed to come to be fed. The hood being then removed, the hawk flies to the lure, and is exercised in this way for some time daily, until she is sufficiently tractable to be trusted without a line, care being taken not to feed her until she has flown, and always to reward her for coming to the lure with a morsel of the meat with which it is garnished. She is then *entered* at the *quarry* at which, she is intended to be flown (partridge, rook, or whatever it may be) by first giving her a live bird at the end of a long line, and allowing her to go off the fist and kill it; eventually the line is dispensed with, and she is flown at wild quarry.

Such, briefly, is the mode of training a passage-hawk. An eyess is somewhat differently treated. A straw-covered platform is put up in some shed or outhouse, and on this the nestlings are placed, the platform being about as high up as one can reach to feed the birds. They are fed three times a day on fresh lean beef, while growing. When they are strong enough and able to fly, jesses are put on the legs, and a spherical brass bell on one leg, fastened just above the *jess* with a little narrow strip of leather termed a *bewit*. At feeding time, now once a day, they are called to the lure, and, being allowed their liberty for some weeks (in which state they are said to be *flying at hack*), they daily gain strength and wing-power, until the time comes for taking them up and commencing their training which after this stage does not differ much from the method above described for passage-hawks. The first operation in training is *hooding*, which, if successfully performed, overcomes much difficulty. The hood is simply a cap of leather made to fit the head in such a manner as to obscure the light, a single aperture only being left, through which the beak protrudes, and a slit behind, which is opened and closed, when the hood is put on and off, by means of *braces*, one pair of which opens, the other pair closes the slit; the eye-pieces, which to prevent injury to the eyes, are carefully *blocked out*, are covered for ornament with red or green cloth. By temporarily blindfolding the hawk, the hood causes her to sit perfectly quiet, and prevents her from *bating*, or fluttering, at the risk of breaking feathers, as she would do if frightened by passers-by until gradually accustomed to them.

Among the older works on falconry, Simon Latham's *The Falconer's Lure and Cure* (1633) is one of the very best. Schlegel's *Traité de Fauconnerie* (1844–53) ranks high among modern treatises, and contains a very full bibliography. Other excellent works are *Falconry in the British Isles*, by Salvin and Brodrick, admirably illustrated; *Falconry: Its History, Claims and Practice*, by Freeman and Salvin; G. E. Freeman's *Practical Falconry*, and *Falcons and Falconry*.

Faldstool, fôld′stōōl, a movable folding chair used by bishops or other ecclesiastics of high rank when not occupying their throne or when in other than their own churches. The term is also used for a small desk used at the ceremony of coronation or by the clergy for the saying of the Litany.

Falémé, fä-lā′mā, or TENNE, river Senegambia, West Africa, rises on the northern borders of French Guinea, and flows over 200 miles, generally north, through the hilly region between

Bondu and Bambuk, to join the Senegal on the left bank, some 25 miles southeast of Bakel.

Falerii, fa-lē′ri-i, ancient town, Etruria, Italy, not far from Mount Soracte. One of the league of twelve Etruscan cities, it was taken by the Romans in 394 B.C. In 241 it revolted, and was destroyed.

Falernian Wine, fa-lûr′ni-*an*, a famous wine of ancient Roman times, praised by Horace. It was made from grapes grown in the *Falernus Ager*, in the northwest of Campania. When aged, it was very fiery, and was generally tempered with Chian wine. The color was a clear light yellow. It is still made.

Falguière, fal-gyâr′, JEAN ALEXANDRE JOSEPH (1831–1900), French sculptor, pupil of Jouffroy, was born in Toulouse. His first work exhibited at the Salon (1864) was *The Winner of the Cockfight* (Luxembourg, Paris), an original and vivid conception, followed by *The Young Martyr Tarcisus* (Luxembourg, 1867) and *St. Vincent de Paul* (Panthéon). His statues of *Lamartine* (1876) and Eve (1880), and his two markedly different conceptions of *Diana* (1887 and 1891) established his reputation for vigorous, sympathetic, thoroughly modern work, further confirmed by the later productions of his chisel, *Progress Abasing Error* (Panthéon), and the *Poet Holding a Lyre* (Place de l'Opera), a figure of striking simplicity and grace.

Faliero, fâ-lyā′rō, MARINO (?1274–1355), doge of Venice, elected in 1354, after a distinguished career as a military leader, in the course of which he defeated the Hungarians and captured Zara, and as ambassador of the republic. Shortly after his election he was discovered in a conspiracy with the plebeians to overthrow the patrician tyranny, and was executed. There is a legend that Faliero or his wife suffered an insult at the hands of a young noble, and that it was the failure of the patrician tribunal of 'The Forty' to impose more than a nominal sentence upon the offender that led the doge to plot the overthrow of the aristocracy.

Falk fälk, PAUL LUDWIG ADALBERT (1827–1900), German jurist and statesman, was born in Metschkau in Silesia. He was educated at Breslau and Berlin, and after holding many public offices was appointed minister of educational and ecclesiastical affairs in Prussia (1872), in which office he strenuously supported Bismarck in the Kulturkampf, and introduced the celebrated 'May Laws,' directed against the Roman Catholic Church (see GERMANY, *History*). Falk resigned office in 1879, but retained his seat in the Reichstag till 1882, when he was elected president of the superior court of justice at Hamm.

Falkenhayn, ERICH VON (1861–), German general, became Prussian minister of war in 1913, succeeded von Moltke as chief of staff in 1914, was responsible for the first Battle of Ypres (1914), and prepared the great onslaught on Verdun, the failure of which led to his retirement (1916). In the fall of 1916 he was in command of the Austro-German offensive against Roumania across the Transylvanian Alps, and in 1917 of the German-Turkish armies in Mesopotamia and Palestine. He wrote *General Headquarters, 1914–1916, and Its Critical Decisions*, which has been translated into English.

Falkenstein, fälk′en-stīn, town, Saxony, 18 miles southwest of Zwickau. There are deposits of topaz in the neighborhood. Cotton goods, lace, and window blinds are manufactured. Pop. 15,700.

Falkirk, fôl′kerk, market town, parliamentary and municipal burgh in Sterlingshire, Scotland; 25 miles northwest of Edinburgh; once famous for its cattle 'trysts' or open markets, now held on Stenhousemuir, 3 miles northwest. In or near the town are the Carron, Camelon, and other iron works. Coal mining is extensively carried on, and brewing, distilling, tanning, brick and tile making, and the manufacture of chemicals are among other industries. Near the town the Scots under Wallace fought an engagement with Edward I., in 1298, and here in 1746 Prince Charles Edward defeated the English under General Hawley. Pop. (1938 est.) 38,200.

Falkland, fôk′land, LUCIUS CARY, SECOND VISCOUNT (?1610–43), English writer and politician, was born in Burford in Oxfordshire, and was educated at Trinity College, Dublin. At Great Tew, near Oxford, he made his house a meeting place for scholars and theologians, poets and men of letters, among whom were Hales, Chillingworth, and Clarendon. In the Long Parliament, as representative of Newport, Isle of Wight, he at first strongly supported the popular cause; but he gradually inclined to the opposite side, and in 1642 accepted the post of secretary of state. On the outbreak of hostilities he took an active part on the royalist side, and was killed at the battle of Newbury (Sept. 20, 1643). He wrote *Poems* (collected by A. B. Groshart in 1870) and a *Discourse on Infallibility* (1651).

whale products. Stanley, in the northeastern part of East Falkland, is the only town of importance. Pop. 3,252, mostly Scotch.

The Falkland Islands were discovered by John Davis in 1592. British occupation dates from 1832. In the Great War of Europe a battle was fought, December 8, 1914, off the Islands, between a British and German squadron, in which four out of five German battleships were sunk.

Fall, THE, a term applied in Christian theology to the disobedient act of our first parents, as described in the third chapter of Genesis, whereby sin entered into and gained an ascendency over the human race. The connection between the first act of transgression and the sinfulness of mankind at large is indeed not overtly expressed in the Old Testament, but is is explicitly asserted in the Apocrypha (*e. g.* 2 Esdras iii. 21, 22) and in the New Testament (Rom. v: 12 *f.*; 1 Cor. xv. 21 *f.*), thus providing Christian theology with one of its most perplexing problems. First of all, there is the difficulty of exegesis. Is the story of Adam's sin literal history, or myth, or allegory? And again, since Paul seems to accept the narrative as historical, there arises the question whether the race is included under Adam's guilt and condemnation by the decree of God, or whether there is a real inheritance of his sinful nature. The parallel drawn by Paul between Adam and Christ seems certainly to indicate that the transgression of the former has in some way influenced for evil the whole of mankind, and upon this the church has built up the much-vexed doctrine of original sin. See ADAM; ORIGINAL SIN; SIN.

Fall, ALBERT BACON (1861–), an American cabinet official was born in Frankfort, Ky. He received his education in the country schools, studied law, and was admitted to the bar. He later acquired farm and mining lands in New Mexico, entered the New Mexico territorial legislature, and was attorney general and associate justice of the territorial Supreme Court. He was a member of the constitutional convention and upon the admission of New Mexico as a State (1912) became U. S. Senator, in which capacity he served until 1921, when he was appointed Secretary of the Interior by President Harding.

Fallacy, fal'*a*-si. Fallacies are errors in reasoning, to be distinguished from illusions, which are false perceptions, and from errors of judgment in comparison, etc. A formal fallacy is one which violates the formal laws of reasoning, and which can therefore be detected without reference to the subject-matter reasoned about—*e.g.* in a hypothetical syllogism, to infer the falsity of the consequent from the falsity of the antecedent is fallacious, because this antecedent need not be the only condition of the truth of the consequent. Material fallacies are those whose detection and exposure require an appeal to our knowledge of the subject-matter reasoned about. Thus fallacies which turn upon an ambiguity of terms may, when the ambiguity is exposed, be seen to be formally fallacious, but the exposure of the ambiguity requires a reference to the subject-matter, and the fallacies are so far material.

Clément Armand Fallières.

Ambiguity of language is itself one of the main sources of fallacy, because it naturally involves more or less confusion of thought. Even fallacies not usually classified under the head of ambiguity —*e.g.* the fallacies termed *ignoratio elenchi* and *petitio principii*— are often due to the misapprehension of an opponent's meaning. Consult Sidgwick's *Fallacies.*

Fallen Timbers, BATTLE OF. See WAYNE, ANTHONY.

Falliéres, fà-lyâr', CLÉMENT ARMAND (1841–1931), eighth President of the French republic, was born in Mézin, department of Lot-et-Garonne. He became a lawyer and was mayor of Nérac in 1870–73. In 1876 he was elected a Republican member of the Chamber of Deputies from the arrondissement of Nérac and soon became conspicuous as a speaker and debater on the Republican Left. The following year he was re-elected. He was under-secretary in the ministry of the interior (1880–82) and for twenty-two days during the following January he was prime minister. He was minister of public instruction for two years (1883–1885) under Ferry; minister of the interior under Rouvier (1887); and of justice under Tirard, when he took the portfolio of public instruction, which he held until 1890. After this he served for two years as minister of justice under Freycinet. Having entered the senate from Lot-et-Garonne in 1890, he was chosen president of that body in 1899, an office which he filled for seven years. In 1906 he was candidate of the Radical Republican and the Socialist *bloc* for President of the Republic, and was elected by the National Assembly (Jan. 16) by a vote of 449 to 371, his opponent being Paul Doumer, a candidate of the reactionary elements. He was succeeded (1913) by M. Poincaré.

Falling Sickness, a popular name for epilepsy. See EPILEPSY.

Falling Stars, also called 'shooting stars,' minute planetary bodies raised to incandescence by the resistance offered to their motion by the earth's atmosphere. Over a hundred millions, including those telescopically visible, are estimated to be swept up daily by our planet, yet with no sensible increase of its mass, the vast majority of these cosmic particles weighing probably only a small fraction of an ounce. They fall about twice as thickly in the morning as in the evening hours, because the advancing side of the globe is fully exposed to their bombardment, while the hemisphere behind is sheltered from it. They approach from every direction indifferently, generally with parabolic velocity; begin to glow perceptibly at an average elevation of 70 miles, survive through flights from 40 to 50 miles in length, and become extinct by the entire consumption of their materials while still 20 miles or more from the earth's surface. See METEORS.

Fallmerayer, fäl'me-rī'er, JAKOB PHILIPP (1790–1861), Austrian historian, linguist, and traveller, was born in Tschötsch, in Tyrol. After being professor at Landshut (1826–31), he travelled in Egypt, Nubia, Palestine, Syria, Greece, Turkey, and other countries, and advanced the theory that the modern Greeks are Slavonians, and not the same race as the ancient Greeks. His more important works were *Geschichte des Kaiserthums Trapezunt* (1827), *Geschichte der Halbinsel Morea im Mittelalter* (1830–36). *Ueber die Entstehung der*

Neu-Griechen (1835), and *Fragmente aus dem Orient* (1845).

Fallopian Tubes, in the human female, the ducts passing from either uterine cornu to the ovary, through which the ovum is conveyed to the uterus. See UTERUS.

Fallopius, GABRIEL (1523–62), Italian anatomist, was born in Modena, was a pupil of Vesalius, was professor of anatomy at Ferrara, Pisa, and Padua successively, and at his death was director of the botanical garden, Padua. He is famous chiefly for his discoveries in physiology. He was the first to recognize the peculiar functions of the Fallopian tubes, and he threw much light on the structure and internal working of the ear and other organs. His chief work was *Observationes Anatomicæ* (1561).

Falloux, FRÉDÉRIC ALFRED, PIERRE, COMTE DE (1811–86), French politician, historian, and man of letters, was born in Angers. His *Histoire de Louis XVI.* was published in 1840 (newer ed. 1886), and was followed, three years later, by a *Histoire de Pie V.* (newer ed. 1869). After the revolution of 1848 he became reconciled to the republic and was elected a member of the constituent Assembly. He acted as minister of public instruction (1848–9), and during that time formulated an educational law favorable to the clergy. He resigned after the *coup d'état.* He became an Academician in 1856. Among his published works are *Madame Swetchine, sa vie et ses œuvres* (1860); *De la contre Révolution* (1878); *Études et Souvenirs* (1885).

Fallow, in its original sense meant a period of rest for cultivated land. The term black or bare fallow applies to both tilled and untilled land kept free from cropping for a season, in order to allow the weathering and biological agencies a better opportunity to render the plant food of the soil available. It gives best results on at least moderately fertile, clayey soils, which are retentive of plant food. Since it has been clearly shown that black fallowing is a species of soil robbery, causing losses of considerable amounts of plant food, the system has been largely replaced by the more rational practice of green fallowing, which consists of growing crops particularly leguminous plants, on the soil in intervals of other cropping, to increase and conserve the available plant food, improve the tilth, and choke out weeds. The green fallow is especially applicable to poor, light soils, but it is more likely to suffer from drought in the fall than is bare fallow. The practice of ploughing stubble land after harvest and keeping it free from weeds until grass, grain, or other crop is seeded in the fall is known as bastard fallow in Scotland and short fallow in America. See FERTILIZERS; ROTATION OF CROPS.

Fallow Deer (*Cervus dama*), a native of the countries bordering the Mediterranean, whence at some unknown date it was introduced into Central Europe and Great Britain, where it leads a vigorous semi-domesticated life in many parks. Apart from the conspicuous white spots, which are absent in some varieties, the fallow-deer can be recognized by the characteristic antlers of the stag. These are rounded at the base, but expand at the tip into a flattened palmate structure. The brow-tine is large, and there is no bez-tine. The males stand about three feet high at the shoulders. Females and fawns can be distinguished from those of the smaller roe-deer by the longer tail, and by the conspicuous dark stripe which runs along the middle of the back and down the tail.

Fallows, SAMUEL (1835–1922), American clergyman, born in Pendleton, Lancashire, England. Coming to America in 1848, he was graduated (1859) from the University of Wisconsin, and from 1859 to 1861 was vice-president of Galesville University. He entered the Union army as chaplain in 1862, became colonel, and was brevetted brigadier-general before the close of the war. From 1859 to 1875 he was a minister of the Methodist Episcopal Church, and in the latter year joined the Reformed Episcopal Church, becoming rector of St. Paul's R. E. church in Chicago. In 1876 he was made bishop. He held educational positions in Wisconsin from 1866 to 1874, and was chairman of the general educational commission of the World's Congresses at the Chicago Exposition. Among his published works are: *Briticisms, Americanisms, Colloquial Words and Phrases* (1883); *Synonyms and Antonyms* (1884); *Abbreviations and Contractions* (1884); *Life of Samuel Adams* (1898); *Splendid Deeds* (1899); *Popular and Critical Biblical Encyclopædia* (1901); *Story of the American Flag* (1903); *Christian Philosophy* (1905); *Health and Happiness* (1908).

Fall River, city and port of entry, Bristol county, Massachusetts, is situated on the eastern shore of Mount Hope Bay, an arm of Narragansett Bay, at the mouth of the Taunton River, near the boundary of Rhode Island, and on the New York, New Haven, and Hartford Railroad; 50 miles southwest of Boston. The Fall River Line furnishes daily steamship communication with New York, and the Dyer Transportation Company makes daily trips to Providence. Electric railways run to Providence, Taunton, New Bedford, and Newport. The harbor accommodates the largest vessels. The climate is favorable, with mild winters and summers tempered by cool breezes from the bay.

The city is well laid out, with many fine buildings and business blocks. There are nearly 140 miles of streets, most of them paved and macadamized. The three principal parks, South Park, North Park, and Ruggles Park, comprise nearly 100 acres, 90 of which have been improved. There are also three small parks, Durfee Green, Cambridge Green, and Eastern Avenue.

Among the more important buildings are the State armory, the customs house, post office, city hall, public library (about 100,000 volumes), and the Durfee high school. Educational and philanthropic institutions include Notre Dame College, Bradford Durfee Textile School, Fall River Conservatory of Music, and Fall River Training School; Children's Home, Home for Aged People, City, Truesdale, Emergency and Union hospitals; the Y. M. C. A., the Women's Union, and the Boys' Club. Churches of note are the Central and Fowler Congregational Churches; First and Trinity Baptist; First and St. Paul's Methodist Episcopal; Church of the Ascension, St. John's and St. Mark's (P. E.); United Presbyterian; Unitarian; and St. Mary's Cathedral, St. Anne's, Notre Dame, and St. Patrick's (R. C.).

Fall River is pre-eminently a manufacturing city. Abundant water-power is supplied by the Quequechan River, the main mill stream of the city, which descends 127 feet in less than half a mile from Watuppa Lake, and flows beneath City Hall and Main Street. Across it many mills are built, with their waterwheels directly in the bed. In 1937 there were in Fall River 246 business establishments. These establishments employed 23,428 wage earners, with a payroll of $18,765,318. Products were valued at $68,092,847. The manufacture of cotton, which is the chief industry, is carried on on a greater scale than in any other city in the United States. Approximately 500,000 bales of cotton are annually converted into yarn and cloth. Until recently the great staple was print cloth, but there is also a considerable output of finer goods,

such as sateens, lawns, fine zephyrs, lace curtains, ginghams, etc. The industries next in importance are the dyeing and finishing of textiles, manufacture of shirts, underwear, braid, shoe laces, thread, cordage, mops and other articles of cotton; ship building and repairing; iron founding, and the manufacture of textile machinery. Fall River has recently become an important receiving and distributing center for fuel oil, a $5,000,000 refinery having been completed in 1920.

Fall River was first incorporated in 1803, having previous to that time been included in Freetown. After 1803 it was for a time called Troy, but its original name was restored in 1834. In 1813 two cotton and woollen factories were built, the beginning of a world-famous industry. In 1843 a great fire almost totally destroyed the city. In 1854 it was chartered as a city, and in 1862 was enlarged by the annexation of Fall River in Newport county, Rhode Island. In 1904 Fall River witnessed the most serious strike in the history of the American textile industries, resulting in the exodus of nearly 7,000 of its population. Pop. (1910) 119,295; (1920) 120,485; (1930) 115,274; (1940) 115,567.

Falls City, city, Nebraska, county seat of Richardson county, is situated in the extreme southeastern corner of the State, on the Nemaha River and on the Chicago, Burlington, and Quincy, and the Missouri Pacific Railroads; 80 miles southeast of Lincoln. It has railroad shops and manufactures of flour, stock powder, confectionery, ice, and butter. It is a shipping point for grain and live stock. Pop. (1910) 3,235; (1920) 4,930.

Falmouth, township, Barnstable county, Massachusetts, on Vineyard Sound and Buzzards Bay, opposite New Bedford, and on the New York, New Haven, and Hartford Railroad. It includes North Falmouth, West Falmouth, Falmouth, Quisset, Woods Hole and other villages, is important in the cranberry industry, and is much visited as a summer resort. There are a public library and a high school. The town was settled in 1638 and incorporated in 1686. Pop. (1910) 3,144; (1920) 3,500.

Falmouth, municipal and parliamentary borough (with Penrhyn), seaport, and popular watering place, Cornwall, England, on Falmouth Bay; 11 miles south of Truro. It has one of the finest harbors in England. There are docks and shipbuilding yards, an important coasting trade, and fishing industry. Pop. 13,136.

False Acacia. See ROBINIA.

False Decretals. See PSEUDO-ISIDORIAN DECRETALS.

False Imprisonment, is the confinement or detention of a person without lawful authority. It generally involves at least a technical assault in the sense that a person is coerced by threats or gestures into suffering himself to be detained or imprisoned. It is an indictable offence, and also gives a private right of action for damages and a writ of *habeas corpus* (q. v.) may be applied for. It is not necessary that the imprisonment should be in a house: the mere detention of a person against his will is enough. See MALICIOUS PROSECUTION.

False Point (so called because frequently mistaken for Point Palmyras), cape, harbor (opened 1860), and lighthouse (visible 19 miles), Cuttack district, Bengal, India, 20° 20′ 10″ N. The harbor is the best, with the exception of the Hugli, on the east coast of India.

False Pretences, fraudulent misrepresentation of fact made for the purpose of wrongfully obtaining money or property from a person, and actually inducing him to part with it without consideration. This is a penal offence under statutes in the United States and England, although in some states the offence is classed as larceny. See FRAUD, LARCENY.

False Swearing. See PERJURY.

Falsetto, the name given to the highest register of male voices. The term probably originated in the entirely different tone-color of this register from that of the others. See VOICE.

Falstaff, SIR JOHN, Shakespeare's greatest comic character, appears in the play of *Henry IV.* as the companion of Prince Hal, and again in private life in the *Merry Wives of Windsor.* The original name of the character was Sir John Oldcastle, the Lollard martyr, but this was changed to Sir John Fastolfe, an English general (?1378–1459) who had acquired an unfounded reputation for cowardice in the French wars, and had been owner of a certain Boar's Head Tavern.

Falster, Danish island, in the Baltic Sea, south of Sjælland (Zealand), is about 30 miles long and from 2 to 13 miles broad. It is very fertile, and agriculture (fruit raising) and dairying are the important industries. The chief town is Nykjöbing. Pop. 37,460.

Falun, town, Kopparberg county, Sweden, 56 miles west of Gefle, famous for its copper mine, which is classed among the richest in the world and has been worked since the fourteenth century. Textiles, leather, and pipes are manufactured. Pop. (1939) 13,867.

Famagosta, or FAMAGUSTA, seaport on the east coast of Cyprus, on the supposed site of ancient Arsinoë, 25 miles northeast of Larnaka. Pop. 4,000.

Fame, Hall of. See NEW YORK UNIVERSITY.

Familiar, an evil spirit in attendance upon a magician, wizard or other professor of the black art, frequently in the form of a black dog or cat, or other animal. Consultation with those who have familiar spirits is expressly forbidden by the Mosaic law (Lev. xix:31).

Familiars of the Holy Office, an order of laymen, also called the Militia of Christ, established by St. Dominic (13th century) to assist the Inquisition in its work. See INQUISITION.

Families, Royal. See ROYAL FAMILIES.

Family. The family as an actual institution is a social group consisting of a man, his wife (or wives), and their children, with an outer circle of kindred of uncertain extent. In some cases the conception is wider, including pious reference to former generations and a consideration of generations yet to come. The popular conception probably still is that the original family was patriarchal in character; and to this conception the early records of Genesis seem to give their support.

In the pure patriarchal family, the authority of the father was absolute. His children and his children's children, his sons and his sons' wives, their property, their earnings, all were his. His power extended, in the iron days of Roman history, to that of life and death, and no one could question his authority or his decisions. At his death he was succeeded as 'house father' by his eldest son, but the other sons were not subject to the new authority. They set up for themselves, and became cognate branches of the family.

The habits and customs of native races show that, while all civilized and most semi-civilized or even uncivilized peoples have reached the patriarchal stage, there are still primitive peoples in Australasia, and the South Seas in particular, who have never reached this stage. Hence it has been argued that all races have passed through similar primitive stages before arriving at the patriarchal family of history. Briefly, the theory is that the *patriarchal* was preceded by a *matriarchal* form of the family; in other words, the family as we know it disappears, and kinship is reckoned exclusively on the mother's

side. Under this system the woman remained among her own kinsfolk, and received her lover or lovers, who might belong to a hostile tribe or group, by stealth or by night. She was debarred from marrying any of her own kin with whom she lived; but her offspring belonged to her kinsmen and not to its father, even if he could be identified. Kinship was reckoned only on the mother's side. This is known as *beenah* marriage, and in many cases was regularized so that the lover came to join the tribe or group to which she belonged, deserting his own and his rights, and acquiring an uncertain status in the group to which he transferred himself. We have two very familiar instances in Old Testament history. The anxiety of Abraham, and his cautions to his faithful steward to bring back the young Isaac, were inspired by the fear that a *beenah* marriage might be contracted, which would take the young Isaac permanently from his kin; and Jacob, who had worked seven years to establish his status in Laban's tribe or group only to be rewarded with Leah, and then seven years more for Rachel (for whom he had left his own group), was clearly in the wrong, and knew it, when he decamped with Laban's daughters.

The transition to the patriarchal stage came apparently along two lines. A group, generally a group of brothers, took one woman to wife: by what means they removed her from her kin is not clear—possibly by capture, perhaps by purchase. This is generally known as Tibetan polyandry; and here, although paternity is not clear, male kinship is when the group, as in Tibet, was composed of brothers. Polyandry is the outcome of poverty; and it is conceivable that if the group prospered, the chief or head of the group might claim the woman as his, the others finding wives as their means permitted. The other method existed alongside of *beenah* marriage, and was marriage by capture or purchase, where the woman belongs to her captor or purchaser. The transition in both cases depends on increased food supply. Professor Jenks traces this transition to the domestication of cattle, which not only made possible, but also made desirable, an increase of population. Women's labor thus became valuable; and it is probable that this economic change, and change of marriage custom, was accompanied by some loss of position for women, who were now owned or possessed. As Robertson Smith showed, the patriarchal family was not all at once established. Paternity was not yet the accepted condition of the entrance of a child into the family. 'All were his children who were born in his bed'—*i.e.* were borne by his wife; and there was what appears to moderns a shameful looseness on the subject of conjugal fidelity. The notion that actual procreation was necessary to kinship grew slowly, but it was not till it had grown that the patriarchal family was established. Prior to the recognition of that idea there was *ba'al* marriage—a family based on mere possession of the mother.

Underlying the earliest forms of marriage there lies the question of totemism, which was responsible for the prohibition of marriage within the kin (endogamy) and the insistence on exogamy, or marriage outside the group.

See Robertson Smith's *Kinship and Marriage in Early Arabia* (1885); M'Lennan's *Patriarchal Theory* (1885); Lubbock's *Origin of Civilization* (6th ed. 1902); Maine's *Ancient Law* (10th ed. 1885); and essays of Andrew Lang, particularly *Social Origins* (1903). See also MARRIAGE and TOTEMISM.

Family (in zoology), a grade in classification lower than order, composed of genera having a certain grade of likeness. The group is indicated by the termination *idæ*, as Bovidæ, the cattle family.

Family Compact, a term applied to certain alliances formed in the 18th century by the Bourbon kings. The most famous, formed in 1733 between France and Spain, was aimed at the commercial supremacy of England, and this ultimately led to a war between Spain and England in 1739. A second family compact was formed in 1761 between France, Spain, and two Italian kingdoms (Naples and Parma), this also leading to war with England. The term is likewise used in Canadian history to mark the politics of the period before the grant of responsible government, during which a certain number of families in the colonies appeared to monopolize all the offices and emoluments.

Family of Love, or FAMILISTS, a sect founded at Delft (Holland) by David Joris (1505–56), and brought to England by his disciple, Henry Nicolai. The Familists practically rejected doctrine and ceremony, holding that religion was simply love, which made man one with God. In 1575 they unsuccessfully petitioned for toleration from Parliament, and were attacked by the Puritan preachers. In 1580 Elizabeth ordered their suppression as 'a damnable sect.' Blunt asserts that they were Antinomians, denying the existence of sin; and divided into two congregations, the 'Family of the Mount,' and that of the 'Essentialists.' The sect gradually died out during the 17th century. See Blunt's *Dict. of Sects* (1874). The Family of Love was attacked in the writings of George Fox and Henry Moore.

Famine. Famine is said to exist when the price of the staple food is very high; and owing to ignorance and custom, there may be a famine in the presence of abundant food supplies which people do not know how to use. Not infrequently in India there has been a rice famine while wheat was plentiful and available; and in Germany in 1892 the price of rye exceeded the price of wheat simply because people were accustomed to rye, which was scarce, and not to wheat, which was abundant.

The causes of famine are various—deficiency or excess of rainfall, frosts, and unseasonable weather, plagues of insects, grasshoppers, locusts, etc., war and devastation, acting on predisposing social and economic conditions, such as imperfect means of communication, insufficient diversity of industry, lack of thrift and foresight in storing foods in times of plenty, oppressive taxation, etc. The comparative immunity of modern civilization is due to the organization of modern commerce and to the removal of those short-sighted restrictions on buying and selling that were the favorite remedies of legislators in the middle ages. In the middle ages famines were recurrent, but were generally partial in extent; and in modern India, which presents the most striking area for observation, the same recurrent tendency appears.

How many millions died directly or indirectly in India during the famines of the last decade can never be accurately known. In the Irish famine (1846–7), due to the failure of the potato crop, the death-rate was enormously increased both as the result of direct starvation and as the result of 'famine' fever. During the years 1846–7 there was an excess of deaths over the average of 216,716, of which 208,617 were due to famine fever; and even after the famine was over and prices had fallen, 10,000 people died in the next two years of starvation. See Thorold Rogers's *Hist. of Agriculture* (1866–1902), Hunter's *Indian Empire* (new ed. 1893), and Curschmann's *Hungersnöte im Mittelalter* (1900).

Famund, or FAEMUND, lake, Norway, 83 m. S.E. of Trondhjem, 2,200 ft. above sea-level; length 37 m.; extreme breadth, 5 m. See NORWAY.

Fan (Lat. *vannus*), the imple-

ment used for cooling or rather circulating the air, is of Chinese origin. The earliest was a palmetto leaf, but later varieties were made of bamboo, the end split into brins and covered with paper. In the East they have always been symbols of royalty or authority, being intimately connected with ceremonial observance. The article reached England in Elizabeth's reign as a modified tuft of feathers. Folding fans were invented by the Japanese, and Catherine de' Medici introduced this variety from Italy into France. It consisted of the stick (*bois*) and mount of leaf (*feuille*); the former comprised twelve or twenty-four brins, protected by the two guards (*panaches*) of stronger make. These were and still are made of ivory, mother-of-pearl, bone, or wood, ornamented by carving or in ay, the sticks being secured at the head (*tête*) by a pin forming the pivot. The leaf, formed of two equal pieces of paper, silk, lace, parchment, or chicken skin (a fine tough kidskin), is usually the segment of a circle. Paris has always been the headquarters of the fan-making industry in Europe, her productions being characterized by daintiness and ingenuity, while her most famous artists have not hesitated to lavish their skill upon the article. See Octave Uzanne's *The Fan* (1884); Salwey's *Fans of Japan* (1894); Flory's *A Book about Fans* (1895); Lady C. Schreiber's (C. E. Guest) *Fans and Fan Leaves* (1890); Georgiana Hill's *History of English Dress* (1893). For electric fans, see VENTILATION.

Fan, REVOLVING. See BLOWING MACHINES, VENTILATION.

Fanar. See CONSTANTINOPLE.

Fanariots, or PHANARIOTS, the Greek inhabitants of the Fanar quarter of Constantinople, who are the descendants of those noble families who escaped assassination by the Turks at the capture of Constantinople in 1453. Until the revolution of 1821 the direction of military, diplomatic, administrative, and financial affairs was largely in their hands; the dragomans of the Porte and the hospodars of Wallachia and Moldavia (1716–1821) were also chosen from among them.

Fan-cheng, trading stn. in Hu-peh, China, on the upper Han R., in 32° 10′ N., 112° 10′ E.

Fandango, a lively Spanish dance in triple time derived from the Moors—a variety of the *sequidalla* and *bolero*, accompanied by the guitar and castanets, and danced by two persons, male and female. Occasionally the male dancer has a tambourine.

Faneuil, PETER (1700–43), American merchant of Huguenot descent, born at New Rochelle, N. Y. He settled at Boston, where he erected at his own expense a combined market and town hall (1740–2). Smibert, the portrait painter, was the architect. Faneuil Hall was almost destroyed by fire in 1761, was rebuilt in 1763, and was enlarged in 1806, in accordance with designs of the noted architect, Charles Bulfinch. During the Revolutionary period the main hall was often used for meetings of the Whigs or Patriots, and the building came to be known as the 'The Cradle of Liberty.' Subsequently many notable receptions and banquets were given here to American public men and to distinguished foreign visitors, and many eminent American orators have here addressed large gatherings. From time to time changes have been made in the interior, and little of the original exterior remains. See Brown, *Faneuil Hall and Market* (1901). For illustration see BOSTON.

Faneuil Hall. See FANEUIL, PETER.

Fanfani, PIETRO (1815–79), Italian philologist, born at Pistoia in Tuscany. He founded the literary and philological journal, *Ricordi Filologici* (1847), and held posts in the Ministry of Education at Turin, and afterwards at Florence. Chief works: *Vocabolario della Lingua Italiana* (1856; 3d ed. 1891), *Studii sulle Opere di Dante* (1873).

Fanfare, a short flourish of trumpets performed at cornations and other state ceremonies. The fanfare is used with effect by Beethoven in *Fidelio*, and by Schumann in his E♭ symphony.

Fangs (of snakes), the name applied to the grooved or canaliculate teeth down which the poison flows in venomous snakes. The fangs are always few in number and placed on the maxilla. They are absent in the harmless snakes, which have teeth of the ordinary reptilian type. When present the fangs may be posterior in position, as in the tree-snakes (*Dipsas*); such snakes (opisthoglyphs), though poisonous, are rarely dangerous to man, because the backward position of the fangs makes it difficult to force them into a large object. In the deadly cobras and their allies the grooved fangs are anterior in position (proteroglyph), this enabling the animals to use them much more effectively. Finally, in the vipers (rattlesnakes and adders) the highest point of specialization is reached; for here the teeth have a canal instead of a groove, so that the poison is pumped at once into the deepest part of the wound, it being, of course, from the snake's standpoint, important that the victim be disabled as rapidly as possible by injecting the poison into the blood. See H. Gadow's *Amphibia and Reptiles* (1901).

Fannin, JAMES W., JR. (*c.* 1800–36), American soldier, born in North Carolina. In 1834 he removed to Texas, where he took a distinguished part in the war for Texan independence against Mexico. As a captain of the Texan army he participated in the engagement at Concepcion (Oct. 28, 1835), and on Mar. 19, 1836, near Goliad, at the head of about 350 men, he was defeated and compelled to surrender (Mar. 20) by Santa Anna, the Mexican leader, who agreed to send the prisoners safely to some part in the U. S. Fannin, however, together with nearly all of his fellow-prisoners, was treacherously put to death—murdered in cold blood on Mar. 27.

Fanning, coral isl. of the Pacific Ocean, 4° N. lat., 159° W. long. Area, 15 sq. m. Pop. 150. Great quantities of mother-of-pearl are taken from its large lagoon. It was annexed by Britain in 1888, and is utilized as a station on the Pacific cable from Vancouver to Australia (opened for traffic Dec. 8, 1902).

Fanning, EDMUND (1737–1818), American soldier, a Loyalist during the Revolutionary War, born on Long Island, N. Y. He graduated at Yale in 1757, practised law with success in N. C., and, while holding several minor offices, was charged, apparently with justice, with gross corruption and extortion. From N. C. he was practically driven by the 'Regulators'; he then accompanied Gov. Tryon to N. Y., where in 1774 he became surveyor-general. During the Revolutionary War he commanded the regiment known as the 'Associated Loyalists,' was conspicuous in the British partisan service, and in 1783 fled to Nova Scotia. He was lieutenant-governor of Prince Edward Island (1799–1803), and after 1815 lived in London. He became a major-general in the British Army (1794), a lieutenant-general (1799), and a general (1808).

Fanning, JOHN THOMAS (1837–1911), American engineer, born at Norwich, Conn. He rose to lieutenant-colonel of volunteers in the Civil War. His work as a civil engineer includes the construction of public water works in New England, water-power at Minneapolis, on the Spokane R., Washington, the Missouri at Great Falls, and at Helena, Montana. He was also consulting engineer for several railroads. He published *A Treatise on Hydraulic and Water Supply Engineering* (1877).

Fano, tn., episc. see, and seaside resort, prov. Pesaro e Ur-

bino, Italy, on the Adriatic Sea, 29 m. by rail N.W. of Ancona. It possesses a cathedral, but its principal feature is a triumphal arch of Augustus. Pope Clement VIII. was born here in 1536. Pop. 24,730.

Fanö, isl. in North Sea, off S.W. coast of Jutland, Denmark. Area, 20 sq. m. On the E. coast is the chief town, Nordby (pop. 3,000 1934 est.); and on the W. coast the fashionable bathing-place, Fanö.

Fan Palm is a name given to certain palms belonging to the genera Corypha, Chamærops, Sabal, and Livistona. They are often cultivated as greenhouse and window plants, and derive their popular name from the shape of their leaves. Among the best-known species are *Corypha umbraculiferia*, the talipot palm of Ceylon, which grows to a height of over 100 ft.; *Livistona australis*, an E. Australian species, growing to about 70 ft.; and *L. humilis*, a much dwarfer species from Australia.

Fan Palm.
1. Part of inflorescence (male); 2, single fruit.

Fans, or BA-FAN, an African tribe inhabiting the French Congo, in the mountainous region of E. Gabun. Tall, well-formed, orthognathous, and of a lighter complexion than the surrounding races, they are believed to have come from the north-east, and are still pressing west. They are pronounced cannibals. They are skilful workers in iron, but their many brass and copper utensils are obtained by barter. Witchcraft and fetishism constitute their religion. Although cultivating the ground to some extent, they are chiefly famous as elephant-hunters. Tattooing and painting are largely practised, their bodies being almost naked. See Mary Kingsley's *Travels in W. Africa* (1897).

Fanshawe, SIR RICHARD (1608–66), English diplomatist and translator, was born at Ware Park, Hertfordshire. In 1635 he was secretary to Lord Aston, the English ambassador to Spain. At the outbreak of the civil war he joined Charles I. at Oxford, was appointed secretary of war to Prince Charles, and employed in royalist negotiations in Spain, Ireland, and elsewhere. After the battle of Worcester (1651) he was captured, but was released on bail, and in 1659 allowed to go to Paris. After the Restoration he served as ambassador to Portugal and Spain, but incurred the ill-will of Clarendon, and was recalled. He died in Madrid a few days after handing over his duties to his successor. Translations: Guarini's *Pastor Fido* (1647); *Horace* (1652); Camöens's *Lusiads* (1655), etc. See *Memoir* by his wife, ed. by Sir H. Nicolas (1829).

Fan Tan, a game of cards derived from a Chinese gambling game. Any number up to eight may play, a whole pack of cards being used. Any cards remaining at the end of the deal are laid face down on the table. The player at the dealer's left is required to play an ace, or in default to ante and take one of the extra cards. Beginning with the aces the four suites are built up in sequence to the kings, the customary ante being paid whenever a player is unable to place a card at his turn. The one who first exhausts his hand wins the pot, and receives from the players according to the number of cards each holds.

Fantasia, an instrumental musical composition ungoverned by the ordinary forms. The term was originally descriptive of the pieces now called sonatas, and in still earlier times, borrowing from poetry, 'madrigals.' It is employed to express the development of a musical thought —a *fancy* after the manner of the fugue—and is now mainly applied to those showy arrangements of operatic melodies and variations of popular airs which form a sort of musical *mêlange*.

Fanti, one of the Tshi group of negroes occupying the coast lands of the Gold Coast of W. Africa. They are of the same stock as their hereditary enemies the Ashantis, who subjugated them. They are now under British rule. Like the Ashantis, they are fetish worshippers. See Ellis's *The Tshi-speaking People* (1887).

Fantin-Latour, IGNACE HENRI JEAN THÉODORE (1836–1904), French painter, was born at Grenoble, the son of a pastel painter; became the friend of Ingres, Delacroix, Corot, Millet, and Courbet, and of Sir F. Leighton and Millais. He first exhibited at the Salon in 1861, and excelled as a portrait painter and a delicate delineator of flowers. His best-known portrait groups embrace *Hommage à Delacroix* (1846), *Manet's Study at Batignolles* (1870), *Coin de Table* (1872), and *Autour du Piano* (1885). All these are in Paris. Other notable pictures by him are *Scene from Tannhäuser* (1864), *M. and Mme. Edwards* (1875), *M. Adolphe Jullien* (1887), *The Temptation of St. Antony* (1891), and *Prelude to Lohengrin* (1892). He was also distinguished as a lithographer, his subjects being from Wagner, Berlioz, and Schumann. His best works in this line are at Dresden.

Fan-tracery Vaulting is composed of a series of lines cutting obliquely the vaulting surface of a structure, radiating from a central point of initiation, and terminating at the apex of the ceiling, where the boundary line forms a circle, and encloses what is technically termed the *plafond*. A series of intermediate ribs or lines ornaments the lower compartments of the composition while a subdivision of intersecting lines enhances the fan-tracery effect and the decorative value of the whole. A striking example is the vault of Henry VII.'s Chapel, Westminster Abbey. The principle of the fan-vault is somewhat like that of the dome, but it is convex instead of concave. It is the distinctive vault of the advanced Perpendicular period, or Tudor style (*c.* 1512), and had its primary elements in the groin-rib and pointed arch of Early English architecture.

Fao, tn., Asiatic Turkey, at the head of the Persian Gulf, near the mouth of the Shat-el-Arap. The cable to Bushire and India is here connected with the Turkish telegraph system.

Farad, the unit of electrical capacity. It is the capacity of a body which, when charged with one coulomb, or unit quantity of electricity, has its potential raised by one volt. It is equal to 10^{-9} of a C.G.S. unit. The *microfarad* is the millionth part of a *farad* or 10^{-15} of a C.G.S. unit, and is of more suitable size for practical purposes.

Faraday, MICHAEL (1791–1867), English chemist, electrician, and natural philosopher, was born at Newington Butts, London, the son of a blacksmith. In 1813 Sir Humphry Davy, to whom he had applied for help in his design of devoting his life to science, em-

ployed him as assistant in the laboratory of the Royal Institution. After travelling for eighteen months with Davy on the Continent (1813–15), he resumed work at the Royal Institution, and for some years applied himself mainly to chemical research, subsequently turning his attention to electricity and magnetism. He interested himself, also, in the manufacture of glass for optical purposes. His famous discovery of magneto-electric induction was published in 1831, and for the succeeding fifteen years, with an interval of three years (1841–4), during which he was abroad and in poor health, almost every year saw some remarkable discovery made by him in connection with magnetism and electricity. His most important investigations and discoveries were connected with the following subjects: liquefaction of gases (1823 and 1844); identity of electricities from different sources (1833); electro-chemical decomposition (1834); the relation of electric and magnetic forces (1838); magnetic rotatory polarization (1845); diamagnetism (1846); polarity of diamagnetics, and the relation of diamagnetism to crystalline forces (1849), etc. In 1829 Faraday commenced his Christmas lectures, which he continued for many years, and in 1833 he became Fullerian professor of chemistry at the Royal Institution. His lucidity, his experimental skill, and the natural charm of his manner combined to make him extraordinarily successful as a lecturer. His chief published works are: *Treatise on Chemical Manipulation* (1827–1842); *Experimental Researches in Electricity* (1839–55); *Experimental Researches in Chemistry and Physics* (1859); *Forces in Nature* (1860); *Lectures on the Chemical History of a Candle* (1861).

Consult *Faraday's Life and Letters* by Bence Jones; *Faraday as a Discoverer*, by Tyndall; and *Life of Faraday*, by S. P. Thompson.

Faraday's Law. See ELECTROLYSIS; ELECTRICITY, CURRENT.

Faradization, far'*a*-di-zā'shun, the application, for diagnostic or for therapeutic purposes, of a faradic, or interrupted, current, as distinguished from a galvanic, or continuous current. See ELECTRICITY IN MEDICINE AND SURGERY.

Farallones, fā-rā-lyō'nās, a group of six small islands lying 30 miles off the Golden Gate, San Francisco, Cal., forming a line about 10 miles long, parallel to the coast. South Farallone is the site of a light of the first order, 358 feet above mean high water in lat. 37° 41′ 51″ and long. 123° 7″.

Farce, a dramatic piece of a broad comic character; it has been styled caricature personified. Farce differs from comedy in degree only. The aim of both is to excite mirth; but while the latter does so by a comparatively faithful adherence to nature and truth, the former assumes to itself a much greater license, and does not scruple to make use of any extravagance or improbability that may serve its purpose. Farce existed at least as far back as the days of Aristophanes. In the middle ages, buffoonery and comic dialogue were introduced first into the mystery, miracle, and morality plays and 'interludes,' and eventually into regular drama. Though present in many of Molière's comedies farce took no firm hold on popular taste during his time, and disappeared until about the middle of the 18th century, when Gay, with the *Beggar's Opera*, created musical farce, and Samuel Foote developed farce proper. See also DRAMA.

Farcy. See GLANDERS.

Far Eastern Question. See EASTERN QUESTION, FAR.

Farel', GUILLAUME (1489–1565), reformer, French by birth, was born near Gap in Dauphiné, but spent much of his life in Switzerland (from 1523), where he took an active part in spreading Protestantism and organizing Protestant churches. His zeal frequently led him into disorder; for he often entered Catholic churches and interrupted the services. It was through Farel that Calvin settled at Geneva, and a warm friendship developed between the two reformers. Consult *Life* by Bevan, and Blackburn's *Farel and the Story of the Swiss Reformation*.

Farewell Address, an address issued (Sept. 17, 1796) to the American people by President George Washington several months before his retirement from office (Mar. 4, 1797). In it he warned his countrymen against party and especially against sectional strife, and against entangling alliances with foreign nations. 'It is our true policy,' he said, 'to steer clear of permanent alliances with any portion of the foreign world.' In the preparation of the address Washington was greatly assisted by Alexander Hamilton, and to a less extent by James Madison. In 1837 President Andrew Jackson also issued a 'Farewell Address.'

Courtesy Travel & Industrial Development Association of Great Britain & Ireland

FAN-TRACERY VAULTING IN HENRY VII'S CHAPEL WESTMINSTER ABBEY

Farewell, Cape, the southernmost point of Greenland (q. v.).

Far'go, city, North Dakota, the largest in the State, and county seat of Cass county, on Red River, and on the Chicago, Milwaukee and St. Paul, the Great Northern, and the Northern Pacific Railroads; 200 miles east of Bismarck, and 265 miles west of Duluth, Minn. Several important highways pass through the city, including the National Park Highway, Meridian Road, King of Trails, and the Black Diamond Trail. Fargo is the seat of the North Dakota Agricultural College, and has three denominational schools, three business colleges, a modern $1,000,000 high school, hospitals, a public library, an auditorium, and a park system of 180 acres, including a free tourists' camp. It is an important distributing point for wheat, clover, alfalfa, dairy products, cattle, horses, hogs, sheep, and poultry, and ranks also as one of the largest distributing centres for farm machinery in the country. Additional industries include a packing plant, creameries, and manufactures of farm machinery and tractors, food products, clothing, hats, and building materials. Fargo was named after William George Fargo (q. v.). Between 1920 and 1928 the city was enlarged by successive incorporations of adjoining townships and villages. Pop. (1920) 21,961; (1930) 28,619; (1940) 33,109.

Fargo, William George (1818–81), was born at Pompey, N. Y. He was a founder of the great American Express organization which eventually covered the whole of the United States. He, in partnership with Henry Wells, started the carrying business which became famous under the name of Wells, Fargo and Company, employing riders and carriers from coast to coast. He was mayor of Buffalo (1862–66).

Fargus, F. J. See Conway, Hugh.

Faria y Sousa, fä-rē'ä-ē-sō'zä, Manuel (1590–1649), Portuguese historian and poet, was born near Pombeiro, but spent much of his life at the Spanish court (after 1619). Most of his works are written in Spanish, his poems, chiefly sonnets and pastoral eclogues, being in the fantastic style of the Gongorists —the euphuists of Spain. Among his prose works were *The Portuguese Asia* (Sp. 1666–75; Eng. trans. 1695) and *The Ancient and Present State of Portugal* (Sp. 1667–80; Eng. trans. 1705). His poetical works, mostly lyrics, appeared as *Fuente de Aganipe* (4 vols., 1644–6). He also published a commentary on the *Lusiados* of Camoëns (1639).

Faribault, făr'i-bō, city, Minnesota, county seat of Rice county at the junction of the Straight and Cannon Rivers and on the Chicago, Milwaukee and St. Paul, the Chicago, St. Paul, Minneapolis and Omaha, the Minneapolis, Northfield and Southern, and the Chicago Great Western Railroads; 50 miles south of Minneapolis. It is the seat of State schools for the deaf, blind, and feeble-minded, also of the Shattuck School, St. Mary's School, St. James School, Seabury Divinity School, and Bethlehem Academy (R. C.). The city has a public library and opera house, is the cathedral town of the Episcopal diocese, and was the home of Bishop Whipple, known for missionary labors among the Indians. The principal manufactures are musical instruments, furniture, shoes, flour, woollen goods, floor trucks, brooms, windmills, toys, water toboggans, lamps, elevators, butter, and ice-cream. According to the Federal Census for 1919, industrial establishments number 53, with $4,424,890 capital, and products valued at $10,155,358. There are quarries in the vicinity; wheat, corn, and other grains are raised extensively, and dairying is highly developed. Faribault adopted commission government in 1911. The population according to the Federal Census of 1940 was 14,531.

Faridun, făr-i-doon', or Feridoun, a legendary king of Persia, depicted as a wise and just ruler. The legends of Faridun's happy reign of five hundred years may be found in the *Shahnameh* of Firdusi (Eng. trans. by Alexander Rogers).

Farina, fa-rē'na, properly speaking, is a flour made from any grain, root or starch; as generally used, the term is applied either to a coarse flour from corn, used in making puddings, or a wheat flour used as a breakfast cereal.

Farinaceous foods are derived not only from the seeds of the cereal grasses and the Leguminosæ, but also from various roots and tubers. They include wheat, oats, Indian corn, and rice; peas, beans, and lentils; potatoes, arrowroot, tapioca and sago. In virtue of their carbohydrate content, farinaceous foods, by a process of combustion in the body, yield both heat and energy, and they also check proteid waste. They do not, however, enter into the structure of the tissues, although an excess of carbohydrates over the daily needs of the body may be transformed into and stored up as fat.

Farinata degli Uberti, fä-rī-nä'tä däl'yē ōō-ber'tē (13th century), Ghibelline leader. Exiled from Florence, he induced Manfred of Sicily to aid his party with troops, and, assisted by traitors in the enemy's camp, he completely defeated the Guelfs at the battle of Monte Aperti (1260). Dante immortalized him (*Inferno*, canto x.), for opposing the destruction of Florence, proposed by his allies.

Farinelli, fä-rē-nel'lē (1705–82), whose real name was Carlo Broschi, Italian singer, who possessed a remarkable soprano voice, unequalled in compass and power. At the age of seventeen Farinelli made his début at Rome. He went to England in 1734, and with Porpora, his former master, and Senesino started the 'Opera of the Nobility,' in opposition to Handel, in the King's Theatre, with the result that the latter was forced to turn from opera to oratorio. In 1738 Farinelli went to Spain, where he was appointed court singer, a position he retained till 1759, when he was banished by Charles III. Having accumulated a large fortune, he retired to a country house near Bologna.

Farley, James A. (1888–), American politician, was born at Grassy Point, N. Y. He was educated at the high school at Stony Point, N. Y., and the Packard Commercial School in New York City. Remaining in the metropolis, he worked as bookkeeper for a paper company in 1906, then as sales manager of the Universal Gypsum Company until 1926 when he organized James A. Farley & Co. This firm merged in 1929 with five others to form the General Building Supply Corporation of which Farley was president until 1933. He also served as member of the N. Y. State Assembly (1923); as member and later chairman of the N. Y. State Athletic Commission (1925–1933); and as secretary and chairman of the N. Y. State Democratic Committee (1928–). He became chairman of the Democratic National Committee in 1932, and through his skill in politics was partly responsible for F. D. Roosevelt's election and re-election to the presidency. Farley was appointed Postmaster General of the United States March 4, 1933. Shortly after the Democratic National Convention of 1940 he resigned as chairman of the Democratic National Committee and as Postmaster General to become directing head of the Yankees (N. Y. baseball club of the American League) and chief foreign salesman for a manufacturer of soft drinks.

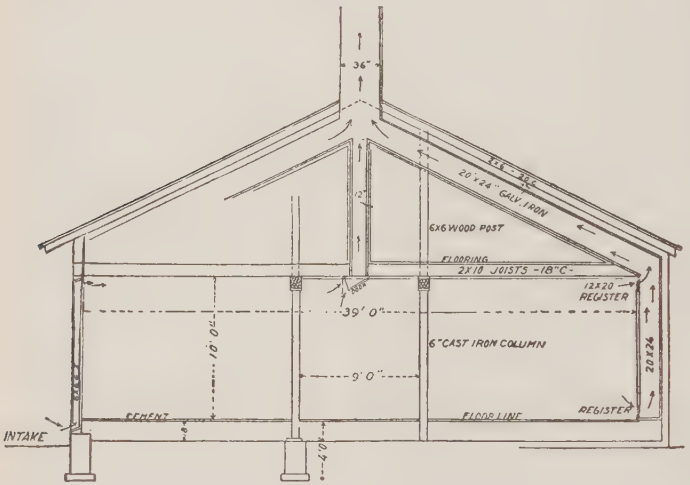
Farley, James Lewis (1823–85), English author, was born in Dublin, entered a banking-house in his native city, and ultimately held appointments at Beirut and Constantinople, and became Turkish consul at Bristol (1870). His wide knowledge of the near East is evident in many political and

financial writings and in historical works.

Farley, JOHN, CARDINAL (1842–1918), American Roman Catholic prelate, was born in County Armagh, Ireland. He was educated in Ireland, in the United States, and at Rome, and was ordained priest in 1870. He served at St. Peter's Church, New Brighton, S. I., until 1872, when he was called to be secretary to Archbishop McCloskey, remaining with him until 1884, when he became a monsignor. He was made vicar-general of the archdiocese of New York in 1891, and domestic prelate to Leo XIII in 1892. In 1895 he became protho notary apostolic, and later auxiliary bishop of New York. Upon the death of Archbishop Corrigan, in 1902, he was appointed administrator of the archdiocese, and later in the same year was made archbishop of New York. At the Consistory held in Rome, Nov. 27–30, 1911, he was elevated to the College of Cardinals. Upon his return to New York in January, 1912, he received a public ovation in which all classes of citizens took part. He proved himself a master in church government, and was one of the most influential religious leaders of the day.

From the time the United States entered the World War (1917–) Cardinal Farley stood squarely behind the Government, for the accomplishment of an enduring peace. He died at his country home, at Mamaroneck, N. Y., of pneumonia, and was buried beneath the altar in St. Patrick's Cathedral, New York City. He wrote *Life of Cardinal McCloskey,* and *History of St. Patrick's Cathedral.*

Farman, ELBERT ELI (1831–1911), American lawyer and diplomat, was born in Newhaven, N. Y. He was graduated (1855) from Amherst, and studied in Europe, was diplomatic agent and judge at Cairo, Egypt, and accompanied General Grant in his voyage up the Nile in 1878. He obtained from the khedive, as a gift to the City of New York, the obelisk known as 'Cleopatra's Needle,' now in Central Park. He wrote *Along the Nile with Grant* (1904); *Egypt and Its Betrayal* (1908).



Ventilation System of Model Dairy Barn.

Farman, HENRI C. (1874–), French aviator and airplane builder, began his career as a painter, became a bicycle racer, then an automobile racer and established the largest garage in Paris. He became a pioneer in aviation, won records for endurance, speed and long distance flights. His first conspicuous feat occurred in January, 1908, when he won the Deutsch-Archdeacon prize of $10,000 for sailing a kilometer in a closed circuit near Paris. Together with his brother Maurice he opened an important airplane factory at Billancourt, supplying both the French and British armies with flying craft. Farman was created a Chevalier of the Legion of Honor in 1909.

Farm Buildings.—A farmstead is the collection of buildings, yards, lots, gardens, etc. necessary for the operation of the farm and for family life. These coördinate units should be arranged in such a manner that there shall be no retracing of steps nor lost motion in executing the routine work of the farm, and also provide privacy around the house. The proper design and good arrangement of farm buildings are economic necessities for profitable farming. Such buildings may be very elaborate and expensive or very simple, their character depending upon the wealth and tastes of the farmer, the size of the farm and the system of farming practised. The lack of adequate buildings often makes it impossible to operate a farm successfully. Without proper buildings the use of livestock is limited and consequently there is usually no profitable way for a farmer to utilize such crops as grasses and legumes which are so effective in preventing the washing and blowing of soil.

As a rule, it is desirable to have the farm buildings centrally located and readily accessible from different parts of the farm, the highway, and electric power lines. An abundance of good water should be readily available, also the site should afford good drainage and plenty of light and air without being unnecessarily exposed. The barn and other buildings should be convenient to the farm house but not so near that fire in one building endangers the others, that the odors of the barnyard reach the house or that the barn seems a part of the house.

The farmhouse no longer is relegated to second place in importance. The first requirement is adequate size to provide needed working area, storage space and living and sleeping quarters. Modern plumbing, lighting and automatic heating systems are no longer considered luxuries; also insulation, electrically operated labor-saving equipment and air conditioning systems are being installed in houses of successful farmers. The house, as indeed all farm buildings, should be designed for comfort, convenience and economy, considering attractiveness and sanitation. The principal farm buildings should be carefully planned not only for present needs but for future enlargements and modifications. The U. S. Department of Agriculture and the various State agricultural colleges, realizing the importance of properly designed farm buildings, have prepared plans and bulletins describing the essentials to be observed so that when built the structures will represent the best possible investment.

As regards general importance the barn stands next to the farmhouse. In respect to farm profits it stands first. Barns are generally designated by the crop or animal sheltered, such as hay barn, tobacco barn, general barn, etc., or by physical characteristics such as braced rafter, Gothic, round, Gambrel, bank, one-story,

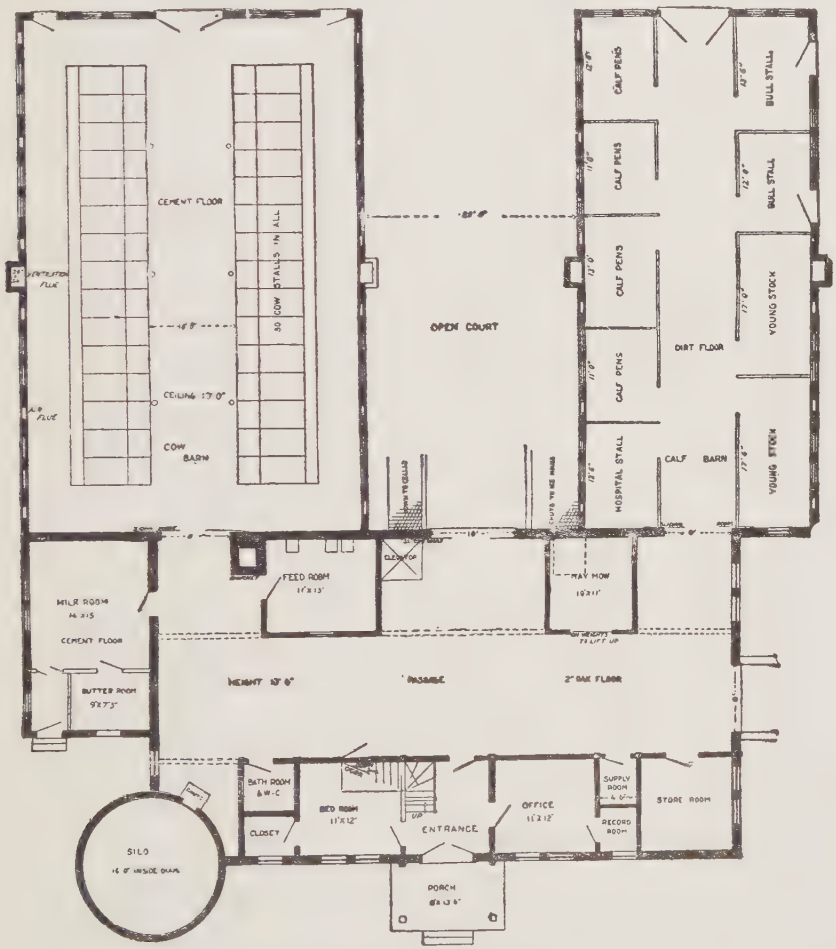
Farm Buildings

etc. A characteristic of modern barns is that the light rigid frame is built almost entirely of lumber 2 inches thick and from 4 to 12 inches wide thus requiring only ½ to ⅓ the amount of lumber used for the heavy framing employed years ago.

Ventilation and sanitation of stables or that portion of the barn houses so oriented that the sun will shine upon the floor during the farrowing season. Later they are moved, with their pigs, to individual houses or located in fields where they can graze. Chickens are kept in flocks of 100 to 250 birds and housed in small buildings to accommodate the flock or in long structures 18

ment and extension of electric power have changed the character and appearance of such structures.

The round vertical silo and the windmill are passing from the landscape in some locations with the advent of trench silos and pumps operated by engines or electric motors.



Ground Plan of Kentucky Station Dairy Barn.

where animals are housed is very important for the production of clean milk and cities have their own sanitary regulations governing the production of milk sold within their corporate limits. Milk houses and other structures where milk is processed must conform to similar enactments. Hogs and chickens are not housed in the main barn. Hogs are kept in individual houses when only one or two are raised. Larger numbers are kept in colony

to 20 feet wide which are divided into 2 or more pens. Recently multiple story poultry houses holding 2000 to 5000 birds have come into use for intensive poultry raising.

Other special buildings for sheep, storage of potatoes, hay, tobacco, and other farm products are required where such animals or crops are raised. Implement sheds, garages, etc. are also generally provided. Recent improvement of air control equip-

The materials used for building purposes have greatly increased in variety in recent years, concrete and tile especially superseding wood and native stone to a considerable extent. The wood fences and stone walls so common in the past are employed now chiefly for ornamental sections of fences or for barn yards. Woven wire in its various forms and barb wire are generally used.

Consult Bulletins by the U. S. D. A.; W. A. Foster and D. G.

Carter, *Farm Buildings;* W. E. Frudden, *Farm Buildings and How to Build Them;* A. Hopkins, *Modern Farm Buildings;* F. T. Struck, *Construction and Repair Work for the Farm;* B. Halbert, *Better Homes Manual;* D. N. McHardy, *Modern Farm Buildings* (1932); E. Gunn, *Farm Buildings* (1935); L. M. Roehl, *Farmers' Shop Book* (1936).

T. A. H. Miller,
Agricultural Engineer,
U. S. Bureau of Agricultural Engineering.

Farmer, John (1789–1838), American genealogist, was born in Chelmsford, Mass. He was one of the founders of the New Hampshire Historical Society, and for a number of years its corresponding secretary. He published the *Genealogical Register of the First Settlers of New England* (1829).

Farmer, Moses Gerrish (1820–92), American inventor, was born at Boscawen, N. H. In 1847 he first turned his attention wholly to scientific pursuits and invented an electro-magnetic locomotive. In 1852 he instituted in Boston the first telegraphic system of fire-alarms. From this time on his inventions followed one another rapidly. The most important were an instrument by which four messages could be sent over one wire at the same time, an electrical cooking stove, a method for depositing aluminum by means of electricity, an electric gyroscope which would run at a uniform speed, a process for covering steel wire with a coating of copper to combine the strength and conductive properties of both metals, and important improvements in the construction of dynamo-electric machines for firing torpedoes. He suggested the use of the continuity-preserving key in the duplex telegraph. In 1872 he was appointed electrician to the U. S. Torpedo Station at Newport, an office which he resigned in 1881 on account of failing health.

Farmer, Richard (1735–97), English scholar, critic, and ecclesiastic. He is best known by his *Essay on the Learning of Shakespeare* (1767), in which—in a pleasant, lively style—he argues that Shakespeare's knowledge of the classics was derived exclusively from translations.

Farmers' Alliance, a movement rather than a single national organization of farmers, originated in farmers' clubs, organized for various purposes in virtually every section of the United States during the 1870's and 1880's. Unlike the Grange, it sprang from the soil. In the newer sections of the west and southwest, clubs were organized to check cattle and horse thieves, protect settlers from land sharks and claim jumpers, etc. Soon they became public forums and centers of social diversion; some experimented with coöperative buying and selling.

The Texas Alliance was the earliest as well as the most virile of the organizations which spread and merged with others to form the basis of the movement. Beginning in 1874 or 1875, it spread through the State and rapidly eastward through the Gulf States, largely because of the energetic and effective leadership of C. W. Macune.

In the meantime a number of similar societies had developed—notably the Agricultural Wheel in Arkansas, Alabama, and Tennessee, and the Farmers' Coöperative Union in Louisiana. By 1888 these various organizations had merged to form what was popularly known as the Southern Alliance.

Meanwhile a Northwestern Alliance, somewhat different in character and quite independent in origin, had developed. Although the legislative programs of the two groups were similar, the efforts at consolidation failed, primarily because of differences in policy with reference to political activity and the survival of sectional feeling.

Because of the widespread distress and resulting discontent in rural America during the 1880's, the membership in these various groups became the vital part of a protest movement. The farmers hoped to remedy their position with reference to the price level and to curb the supposed depression of farm prices by middlemen. The Alliance effected a loose coöperative relation with the Knights of Labor. There was to be common action in lobbying on such questions as the national banks, the subtreasury scheme, the prohibition of dealing in futures of 'all agricultural and mechanical' products, the free coinage of silver, government ownership of railroads and means of communication, etc.

Until 1890 the Alliance avoided partisan politics. The failure of some of the coöperative projects to stem the general economic trend against the farmers turned some of the leaders to political action, and the national Alliance convention at St. Louis in 1889 decided to support candidates who favored its demands. In 1890, the Alliance elected several governors and U. S. senators and about thirty congressmen. At a convention at Cincinnati in 1891, steps were taken to launch a new party. The platform, an outgrowth of Alliance programs developed during the course of a decade, called for free coinage of silver, abolition of national banks, loans on land and real estate, income tax, government control of railroads, election of president, vice-president, and senators by direct vote, non-ownership of land by foreigners, universal suffrage, etc. The Farmers' Alliance movement became the People's or Populist party in 1892. Consult S. J. Buck, *Agrarian Crusade* (1920); J. D. Hicks, *Populist Revolt* (1931).

Everett E. Edwards,
U. S. Dept. of Agriculture.

Farmers-General (*fermiers-généraux*), an association of farmers of the taxes (a term applied to individuals who buy for a certain sum the privilege of collecting taxes) in France, before the revolution of 1789, which was to a large extent caused by their iniquitous exactions. The privilege of farming the taxes, nominally sold to the highest bidder, was generally granted to favorites.

Farmers' Institutes, organizations formed to extend agricultural information and the social welfare of farmers. Springing from the public meetings, held by the State agricultural societies in early days, they received a great development after the passage of the Morrill Act (1862), and the organization of agricultural colleges. They were usually conducted by the State agricultural departments or by the agricultural colleges, and were found in every State. They were usually held during the winter months. Features of the meetings were the reading of papers by specialists or successful farmers of the district, general discussions, and popular lectures. Their place in rural life was superseded by the county agent movement, and their technique of approach is represented in the 'schools' or forums conducted by the extension service of the Federal Department of Agriculture.

Farmers' National Congress, a national agricultural body in the United States, organized in 1881 to secure favorable legislative action on questions relating to agriculture. It consisted of delegates from each State appointed by the governor or other State official. Its activities were of material service in securing free rural mail service, pure food and drug laws, river and harbor improvements, postal savings banks, parcel post service, and other similar measures.

Farmers' Union, The, or, more accurately, the Farmers' Educational and Coöperative Union of America was founded in 1902 at the little town of Point, Texas. Its chief founder,

Farming

Newt Gresham, and others had been organizers and leading officials in the Farmers' Alliance.

The members of the Farmers' Union condemned the demand for cheap food at the expense of their standard of living and hoped to improve conditions, partly by securing the enactment of favorable legislation, but primarily by developing coöperatives and credit organizations.

The first declaration of principles, as set forth in the charter granted to the initial union, was to the effect that marketing, better prices, and fraternal considerations were the objects.

During its first years, the Farmers' Union focused its attention mainly on the marketing of cotton. It fixed a minimum price below which the farmer was advised not to sell. This plan of action was begun as early as 1904. Following 1905, it joined the Southern Cotton Growers' Protective Association, the Southern Bankers' Association, and the cotton exchanges of New York City and New Orleans in their efforts to reduce cotton acreage. The Unions built warehouses for cotton and extended credit. Some direct selling of cotton was also undertaken.

Consult E. D. Wiest, *Agricultural Organization in the United States.*

Everett E. Edwards,
U. S. Dept. of Agriculture.

Farming is the practice or occupation of tilling the soil for a livelihood. The tilling of the land is considered broadly as the growing of crops of all kinds and the rearing of animals maintained on these crops. As the crops and animals are many, so are the kinds of farming numerous. It is customary to divide the occupation into *general farming*, including the growing of grains and forage, with the live-stock that accompanies it; *horticulture* (see Gardening), comprising the growing of fruits, vegetables, flowers or ornamental plants, with the rearing of plants in nurseries for sale; and *forestry* (q. v.), which is the raising of a timber crop. If one specializes in live-stock, the occupation may be known as stock raising, poultry farming (qq. v.), or more particularly as horse breeding or sheep breeding. Bee keeping (see Bees) is also a form of farming. The production of milk and milk-products is dairying (q. v.). The word farming, therefore, does not stand for a single homogeneous occupation, but for a congeries of occupations, all agreeing in deriving income from the cultivation of the earth. Agriculture (q. v.) is a more comprehensive term, covering the occupation of farming as well as the range of life that it maintains. It designates also the economic, social, civic, and political phases of the society that supports itself by farming.

Farming is the fundamental occupation of mankind, producing most of the food and clothing supplies. Some of these supplies are derived from the sea, and so far they renew themselves with little co-operation on the part of man; yet we cannot imagine the race supporting itself on the product of the sea alone. Still other supplies are drawn from the wild, as furs and pelts, no inconsiderable quantity of food, and except in certain parts of Europe, the bulk of our timber. These fortuitous supplies must constantly grow less, relative to population, although a good part of the energy of what we call civilization is yet expended in finding new countries to rob and swifter means of transporting the booty. In the end, however, the race must support itself mostly by growing its supplies with forethought.

This being true, it follows that the conditions under which the farming population lives are a matter of concern to every citizen and must receive the careful consideration of society. If the organization of society is such that greater rewards for one's labor are to be secured in the industries, the population will flow from the rural regions into industrial centres, resulting in lessened supplies of food and clothing, with increased prices, or greater activity on the part of those who remain, or more vigorous measures to obtain products in remote regions of cheap and fertile land.

The price of farm supplies must rise or fall with other values, and, as the general tendency of all values and prices is to rise, the scale of prices for farm produce cannot remain stationary, or even relatively stable, in comparison with former prices, without reducing the income and the plane of living of those who work the land. Society should be as much concerned to maintain the scale of living for agricultural workers as for industrial workers, for if the scale of living does not rise for the rural people consonantly with that of other branches of society, the exodus from farms will be accelerated. Moreover, a reduced or even a stationary plane of living on farms results in the using up of natural capital, or the skinning of the land. This means disaster for society, for we cannot hope to maintain civilization permanently on a practice of soil robbery or exploitation of new lands.

The farmer needs always to improve his methods in order that he may increase his produce at the same time that he saves his soil. Society recognizes this necessity, and has provided institutions for research and for teaching in the rural field. Yet farming cannot hold its own as an occupation by internal improvement alone. The occupation must be safeguarded against predatory interests, and a proper economic equilibrium must be maintained as between farming and other series of occupations. The special protection given to the workingmen, as represented in organized labor, are apt to produce inequalities operating to the disadvantage of farming. The relationships between the farming occupations and others express themselves in politics, a field that is likely to become the special temptation of the demagogue. The farmers of the world have been mostly undemonstrative; but with the greater pressure for food and the widespread education of rural folk, this complacency is likely to pass. The situation demands constructive political policies, founded not in the exigencies and expediences of a particular moment but in fundamental considerations of balance and justice.

The economics of farming, in their relations to human affairs, are only partially expressed in tabulations of yields, prices, and commercial movement. The annual balance-sheets may look very good to the statistician and to the general public at the very time that unrest and apprehension are felt far and wide among the farming people. The measure of good farming is expressed not in yields to the acre, but in yields to the man, although the public still evaluates it by the former standard. It is the natural responsibility of the farmer to increase his acre-yields; yet the profit in such yields and the desirability of them are determined not alone by improved methods and fertility of the particular soil, but quite as much by the price of land and labor, the capital required to stock the farm with tools and fertilizers, and other considerations. It is often cheaper and better, and more frugal of fertility, to produce a given yield on two acres than on one acre. In countries of high-cost labor and relatively low-cost land, as in North America, it does not pay to produce the maximum acre-yield, except, of course, in certain intensive occupations, as glass-house farming. Human labor costs too much, and it is often better to till more acres by the use of machinery. The American farmer cannot afford to terrace his hillsides for the raising of his crops, although such dressing of the countryside might conduce

to the delight of travelers and writers.

The ability of man to produce crops is rising. This is due to a better intellectual grasp of the problems, to more effective tools and machines, and to new chemical and fertilizing methods. Scientific investigations by the U. S. Department of Agriculture have contributed enormously to this progress, to which many of the State agricultural experiment stations have added valuable results. Advances in the sciences of genetics and cytology have revolutionized corn-breeding methods since the dawn of this century. There have been produced strains of corn that in yield and quality surpass any of the varieties previously grown.

The corn breeders first demonstrated the inadequacy or the limitations of the older corn-breeding methods. Then they experimented with various systems of selection during inbreeding and crossbreeding, and with exact matings, under definite control by hand-pollination, between individual plants. The lines developed by selection and self-fertilization gave the corn breeder his first fixed material, and allowed a certainty of progress never possible before. The next step was to test the 'selfed' lines in hybrid combinations. Hybrids so obtained were then planted to produce commercial crops.

But only the first hybrid generation, the seed from the direct crossing of unrelated strains, has maximum value. Only this generation should be called hybrid seed corn. Second-generation seed yields from 10 to 25 per cent less. Hybrid seed must therefore be produced anew for each season's use.

In 1932 it was announced from California that the vegetable world might be near the era often visioned for man, when food would consist of highly concentrated nourishment in pill form, was suggested by achievements in soilless agriculture at the University of that State. Under the direction of Professor W. E. Gericke the cultivation of floral, vegetable and field crops in water, and fed chemically, had progressed encouragingly toward the point of commercial practicability. By the use of 'plant pills' which supply the growing shrub, flower or vegetable with the proper quantities of the required elements which the roots normally obtain from the soil, intensive production was declared to be possible.

At a meeting of the National Academy of Sciences held at Rochester, N. Y., on Oct. 25, 1937, Dr. Albert F. Blakeslee announced the discovery of an elixir for the transformation of plant life which could enormously accelerate evolution, produce new, better, bigger and hardier flowers, fruits, vegetables and, perhaps, trees. It was also capable of turning annuals into perennials and making sterile hybrids fruitful.

The magic material which promised these marvelous results is itself a plant product, an extract from the seeds of the Autumn crocus, the colchicum autumnale or meadow saffron, quite common in Europe and found also in the United States. The extract, called *colchicine,* is a yellow powder, a complex compound of the usual life elements carbon, hydrogen, nitrogen and oxygen. Chemically it is an alkaloid, with a structure related to that of the hormones that control sex characteristics and reproduction in animals and human beings.

The price of *colchicine* at the time of this revelation was about $25 an ounce. The professor used it in solutions of only a fraction of 1 per cent, applying about a drop of the resultant elixir to the stem or buds or seeds of the plant to be treated. He applied it either by soaking the plant material in the solution or by spraying a bit of the solution on the plant with a ten-cent atomizer, and no plant so far had resisted the effects of the chemical.

As a whole, the size of farms is diminishing in the United States. According to Census figures, the average size of a farm in 1850 was 203 acres; in 1935 it was 154 acres, though it had been less in 1880, 134 acres. If a farmer is able to raise more products to the unit of manpower than formerly, it follows that the rural regions may spare some of their population for the industries. This explains in part the rural exodus to the cities. The means of transportation and communication have been vastly improved. The automobile has brought a 20-mile distant town within the range of an after-supper trip and back from the farm; while radio and telephone have greatly reduced the austerity and loneliness of farm life. The farmer, his family and help, are no longer isolated from the bustling haunts of man.

The service of the farmer to society is not merely as a producer of food supplies. The rural range is a type of life, and one of the seed beds of citizenship. It is the nearest approach to a permanent society. It does not move itself in weary search for work, nor find itself unemployed; rarely is its routine disturbed by labor troubles. See AGRICULTURE.

Farm'ington, town, Hartford county, Connecticut, on the Farmington River, and the New York, New Haven, and Hartford Railroad; 9 miles west of Hartford. Here is situated Sarah Porter's Seminary for Young Ladies. Pop. (1930) 4,548.

Farmington, town, Maine, county seat of Franklin county, on the Maine Central Railroad; 70 miles north of Portland. It is the seat of a State Normal School and of the Abbott School for Boys. There are canneries, lumber and grist mills, a wood turning factory, machine shops, and general agricultural interests. Pop. (1930) 3,600.

Farmington, city, Missouri, county seat of St. François county, on the St. Louis, Iron Mountain, and Southern, and the Cape Girardeau Northern Railroads; 58 miles southwest of St. Louis. It has lumber and flour mills, and machine shops. Lead is mined in the vicinity. Carleton Institute and Elmwood Seminary are located here. Pop. (1930) 3,001.

Farm Relief, special or emergency aid furnished to farmers by the Federal Government through the Department of Agriculture, or one of its agencies, to relieve farm distress; in contradistinction to the assistance normally furnished through scientific research, educational extension work, and market regulations. It is essentially a response to profound economic change caused by public as well as private influence. From about 1910 the conditions that affect agriculture in the United States have changed tremendously. Scientific and technical progress have revolutionized American methods of farming, while economic developments here and abroad have contracted the agricultural market. The technical and economic developments have not been harmonized. Agriculture might have adjusted itself spontaneously to these changes had the World War not intervened; but that conflict was responsible for an enormous expansion of acreage, while the aftermath stripped it of the foreign market.

The postwar years were a time of stagnation in American agriculture. Although prices remained high through 1920, they dropped sharply in the following year and, unlike industry, failed to recover. Corn prices dropped more than sixty per cent between 1919 and 1921; cotton, wheat, hogs, and cattle brought only about one-half their former prices. The farmer felt the decline keenly because the prices he paid for industrial products did not drop in proportion to his lowered income, while his taxes were increasing. In 1923 farm prices recovered somewhat,

and held their gains until 1929. Although agriculture shared to some extent in the wave of prosperity that swept the country during those years, it was not in a thriving condition; between 1920 and 1930 about 600,000 people moved from farms to cities each year. The plight of the farmer was worse in regions that were dependent upon a single crop for their prosperity. In many sections of the Middle West, where a balance was maintained between grain production and the raising of livestock, a well-ordered agricultural economy resulted, and farming was frequently a highly prosperous enterprise.

The farm problem, however, had become sufficiently vexatious to cause some political efforts to alleviate it. In 1921 senators and representatives from agricultural states organized a farm bloc in Congress, and began to press for legislation to aid agriculture. Attempts were made to protect American farm products from foreign competition, and a number of acts passed to facilitate credit on better terms for farmers. When these did not alleviate conditions in the agricultural situation, Congress in 1927 and 1928 passed the McNary-Haugen Bills, both of which were vetoed by President Coolidge. In 1929 the Hoover administration secured the passage of the Co-operative Marketing Act in another attempt at agricultural relief. It provided for a sum of $500,000,000 to be lent by the Federal Farm Board to co-operative marketing associations. The Board also attempted to stabilize farm prices.

The economic depression which began late in 1929 reacted disastrously on agriculture. Although production on principal crops declined little, farm income fell 57 per cent from its already low figure. The Farm Board made a desperate attempt to maintain crop prices, but despite its efforts they dropped to levels lower than at any time after the Civil War. In 1933 the new Democratic administration passed a Farm Relief and Inflation Act, based upon the principle that elimination of the agricultural surplus would lead to a rise in prices and bring back farm prosperity. It expanded the farm credit facilities of the government and set up the Agricultural Adjustment Administration (AAA) which attempted to reduce the surplus and increase the farmer's income. This act had three main programs, the first of which authorized the Federal government to help agriculture by entering into contracts with individual farmers for co-operative crop adjustment, and by sponsoring market agreements with producers, processors, and distributors; the second related to farm credit; and the third gave the President broad powers in relation to currency and credit. The AAA's program was to be financed by processing taxes levied on products manufactured from the basic farm commodities.

At that time agriculture had large surpluses of wheat, cotton, tobacco, and other export crops. The wheat carry-over in 1933 was more than three times above normal; there was on hand in the country half a year's average production. The world carry-over of American cotton was two and one half times above normal. Similar conditions existed in the hog industry, which during the World War had trebled its exports, and had not since allowed sufficiently for the shift to postwar conditions. In 1933, 1934, and 1935 the AAA sponsored certain crop adjustments designed to balance supply more nearly with demand. To relieve farmers whose lands were mortgaged, several acts were passed providing more credit and postponing foreclosure dates.

In January 1936 the Supreme Court declared portions of the AAA, including the processing taxes, unconstitutional on the grounds that they were invasions of the regulatory rights of the states. Immediately after this decision the AAA suspended its crop control activities, but continued to administer the marketing agreements. Subsequently these remaining portions of the AAA were attacked in legal suits. On April 27, 1936, Congress enacted a law to replace the Agricultural Adjustment Act. This was the Soil Conservation and Domestic Allotment Act, the primary object of which was the conservation and upbuilding of the soil, though some crop control might result as a by-product. The measure set up five objectives: preservation of soil fertility, diminution of soil exploitation, better use of land, the protection of rivers and harbors against damage from soil erosion, and the attainment of parity income for agriculture. It made for a better crop balance and promoted conservation, but did not give effective crop control. This led to new difficulties resulting from overproduction. With no signs of substantial revival in the foreign market for American agricultural products, Congress again turned its attention toward direct crop control.

It is interesting to note that despite the invalidation of the original AAA, American Agriculture was generally more prosperous during 1937. Farm income was about 10 per cent higher, although crop prices declined, and continued to fall in 1938—an apparent contradiction, explained by a general decline in world commodity prices. In 1938 Congress passed another Agricultural Adjustment Act, which confirmed the earlier soil conservation acts, and attempted to stabilize production by loans to farmers who restricted acreage. It proposed to keep surpluses on farms by loans on crops that were kept in storage. If two-thirds of the farmers of a certain area agreed, quotas were to be put on their production of commodities of which a large surplus seemed likely. Because of the small crops of 1938, few quotas were set for agricultural production in 1939.

See United States History.

Farm'ville, town, Virginia, county seat of Prince Edward county, on the Appomattox River and the Norfolk and Western and the Tidewater and Western Railroads; 53 miles southwest of Richmond. It is the seat of a State normal school, and has tobacco manufactures and lithia springs. Pop. (1930) 3,133.

Far'nam, Henry Walcott (1853–1933), American political economist, was born in New Haven, Conn. He was graduated from Yale (1874; A.M., 1876), and studied at Berlin, Göttingen, and Strassburg. He was tutor at Yale in 1878, and became professor of political economy in 1880. In 1914 he was appointed Roosevelt professor at the University of Berlin but was prevented by the war from filling the appointment. He was chairman of the New Haven Civil Service Board (1898–99), State Commissioner of Sculpture (1887–1909), president of the Connecticut Civil Service Reform Association, president of the American Association for Labor Legislation (1907–10) and of the American Economic Association (1910–11); one of the editors of the *Yale Review* (1892–1911) and of the *Economic Review* (1911–12); member of the Executive Committee of the New Haven War Bureau and of the Publicity Committee of the Connecticut State Council of Defense.

Farnborough, färn'bur-uh, parliamentary and urban district, Hampshire, England; 33 miles southwest of London. It has a Catholic memorial church, built by the ex-Empress Eugénie

(1887), in which she is buried, with her husband, Napoleon III, and their son, the Prince Imperial. In the parish are Aldershot North Camp and the main depot of the British Royal Aircraft Factory. Pop. (1931) 16,-356.

Farnborough, Baron. See May, Thomas Erskine.

Farne Islands, färn, Fearne, or Fern Islands or The Staples, an island group off the coast of Northumberland, England, from 2 to 5 miles northeast of Bamborough, and separated from the coast by the Fairway Channel. Farne or House Island, the largest (16 acres), was the retreat of St. Cuthbert in the seventh century. Harcars and Longstone are specially associated with the heroism of Grace Darling (q. v.). Longstone has a lighthouse 63 feet high, with a revolving light. Total area, 80 acres.

Farnese Family, fär-nā'sā, a famous Italian family which originated in the thirteenth century near Orvieto and was raised to importance by Alessandro Farnese, who became Pope Paul III (1534–1549). He founded the duchy of Parma and Piacenza, and bestowed it upon his natural son, Pietro Luigi, the first of a long line of princes of Parma lasting until 1731. Pietro was succeeded by his son Ottavico, and he by his son Alessandro Farnese (1545–92), who, after fighting at Lepanto (1571), became one of the most noted generals of the period. He was appointed governor of the Netherlands (being nephew of the Emperor Charles V) in 1578; captured Brussels (1584) and Antwerp (1585), and forced Henry IV of France to raise the siege of Paris (1590) and of Rouen (1591). Elizabeth Farnese (1692–1766) married Philip V of Spain, and supported the policy of Cardinal Alberoni (q. v.).

As a family, the Farnese were characterized by marked ability and enthusiasm for culture, generally combined with unscrupulousness, and often with cruelty and licentiousness.

Farnese Palace, in Rome, on the left bank of the Tiber, was begun (1530) by Alessandro Farnese (Pope Paul III), the architects being successively Sangallo, Michelangelo, and Della Porta (1580). The antique sculptures known as the Farnese Bull, the Farnese Juno, and the Farnese Hercules (Naples Museum) were so called either because of their discovery by Paul III or their association with the Farnese Palace.

Farnham, färnam, town of Missisquoi county, Quebec, Canada, on the Yamaska River and the Canadian Pacific and the Canadian National Railroads; 40 miles east of Montreal. The industries include butter and cheese, tobacco, sash and door factories, saw mills, chemical works and fabric factory.

Farnham, Eliza Woodson (1815–64), American philanthropist, was born (Burhans) at Rensselaerville, N. Y. She removed to Illinois in 1835, was there married (1836) to Thomas Jefferson Farnham, a writer, and returned to New York in 1841. In 1844 she became matron of the state prison at Sing Sing, where she successfully inaugurated a system of government by kindness. She retired in 1848; lived in California from 1849 to 1856; and in 1859 organized at New York a society in behalf of destitute women seeking homes in the West. Among other books she published *My Early Days* (1859), and *Woman and her Era* (1864).

Farnworth, färn'wurth, town, Lancashire, England, consisting of Farnworth and New Bury, adjoins Bolton on the southeast. The industries are cotton-spinning and manufacture, machine and engineering works, and coalmining. Pop. (1931) 28,711.

Faro, fä'rō, district of Southern Portugal, coincident with the former province of Algarve. It consists of a narrow, sandy coast strip, backed by higher ground, which culminates on the north in the Sierras, Monchique and Malhão (highest point, La Foia, 2,905 feet). It produces fruits, fish, chestnuts, and wheat, and breeds pigs. Area 1,937 square miles. Pop. (1930) 300,762.

Faro, seaport town, Portugal, capital of the district of Faro (q. v.), is situated on the south coast, 30 miles southwest of the mouth of the Guadiana (Spanish frontier). It is the principal seaport of Southern Portugal. Pop. 12,925.

Faro, fär'ō *or* fä'rō, one of the oldest 'banking' games at cards, which, under the name of 'pharaon,' attained great favor in the reign of Louis XIV. It is a favorite method of gambling in the Western United States. The interest of the game consists in betting on the order in which the cards will be drawn by the dealer from a box, open at the top, in which a full pack is placed. On the table top, or on a separate piece of cloth, thirteen cards of one suit are painted, and the person betting indicates, by means of these, in what order he believes the cards will be drawn.

Faröe or **Faeroe Islands,** fä'rō (Dan. *Færoerne*, 'sheep islands'), a group of Danish islands, in the North Atlantic, 190 miles northwest of the Shetland Islands, and 250 miles southeast of Iceland. The islands number twenty-one, of which seventeen are inhabited. Their total area is 540 square miles

The largest of the group is Stromö (144 square miles), the other large ones being Osterö, Suderö, Sandö, Vaagö, and Borö.

Composed for the most part of craggy, bare cliffs, the islands are separated by narrow passages filled with swift currents. Fishing is the chief occupation; whaling, fowling, and sheep-raising are also important. There are more than 60,000 sheep on the islands. The exports include woolen goods, lamb skins, feathers, and produce of the whaling and fishing industries. The climate is mild and the harbors usually ice-free.

The islands have their own assembly, and are represented in the upper and lower houses of the Danish parliament. The official language is Danish, but the people speak an old Norse dialect. The capital is Thorshavn in Stromö (pop. 2,895). The population of the islands in 1940 was 25,738.

The Faröe Islands were settled by Norsemen, probably in the ninth century. In the eleventh century Norway took possession of the islands and Christianity was introduced. In 1380 the Faröes came under Danish rule after the union of Norway and Denmark.

The status of the Faröe Islands became an international problem after the German establishment of a protectorate over Denmark on April 9, 1940. On April 16 they were occupied by a British force.

Consult J. R. Jeaffreson, *The Faroe Islands;* Annandale, *The Faroes and Iceland;* F. Y. Powell, *Tale of Thrond of Gate;*

Grossman's 'The Faroe Islands,' in the *Geographic Journal* for 1897.

Farquhar, fär'kwär, GEORGE (1678–1707), British dramatist, was born in Londonderry, Ireland, and in 1695 went on the Dublin stage. Timidity and a weak voice prevented his success as an actor, and after seriously wounding a friend in a stage duel, he was readily induced by Wilkes to accompany him on his return to London in 1698. His first play, *Love and a Bottle*, was given at Drury Lane in 1699. *The Constant Couple, or A Trip to the Jubilee*, followed in 1700, and its success prompted the sequel, *Sir Harry Wildair* (1701). *The Inconstant, or the Way to Win Him*, a prose adaptation of Fletcher's *Wild-goose Chase*, appeared in 1702, and also *The Twin Rivals; The Stage-Coach* in 1704, and a military comedy, *The Recruiting Officer*, in 1706. These were all surpassed, however, by *The Beaux' Stratagem* (1707), written in six weeks, while the author was sinking to his death at the age of twenty-eight. Farquhar's wit has not the brilliancy of Congreve's nor is his touch as delicate, but his wealth of amusing episode and his power of humorous portraiture made him the favorite of the 18th century. His remarkably able 'Discourse on Comedy' was published in 1702, in his volume of miscellanies entitled *Love and Business*. Editions of his works appeared in 1718–36 (2 vols.); 1775, with *Life* by Thomas Wilkes (3 vols.); 1840, edited by Leigh Hunt, and 1892, edited by Ewald (2 vols.).

Farquhar, NORMAN VON HELDREICH (1840–1907), American naval officer, was born in Pottsville, Pa. He was graduated from Annapolis in 1859, and saw his first service with the squadron engaged in the suppression of the slave trade on the African coast. In the Civil War he served with the blockading squadron on the Atlantic coast and took part in both attacks on Fort Fisher (q.v.). He became lieutenant commander in 1865. He was in command of the flagship *Trenton* when, with several other war vessels, she was wrecked in the great hurricane in Apia Bay, Samoa, in 1889, but succeeded in saving the crew of 450 officers and men. Later he was commandant at the Norfolk Navy Yard, was commissioned commodore in 1897, and became commander-in-chief of the North Atlantic Squadron in 1899. He was retired in 1902.

Farr, WILLIAM (1807–83), English medical statistician, was born in Kenley, Shropshire. He retired from medical practice in 1838 and entered the Registrar-General's office. His best work is found in his yearly letters on the causes of death in England, in the census reports, and in the volume *Vital Statistics*, published posthumously (1885).

Farragut, far'*a*-gut, DAVID GLASGOW (1801–70), famous American naval officer, first admiral of the U. S. navy, was born at Campbell's Station, near Knoxville, Tenn., on July 5, 1801. His father, a native of Minorca, emigrated to America in 1776, was a cavalry officer in the Continental army during the American Revolution, and subsequently served both in the U. S. army and the U. S. navy. The son was adopted (1808) by Com. David Porter (q.v.), became a midshipman in the U. S. navy (1810), for several years served under Porter, on the *Essex*, and, though a boy, took an active and gallant part in the fight between the *Essex* and the British frigates *Cherub* and *Phœbe* in the harbor of Valparaiso (Mar. 28, 1814). He subsequently went to school for a short time at Chester, Pa., served on several vessels in turn, continued his schooling at Tunis under Rev. Charles Folsom, then U. S. consul there (1817–8), and in 1819 was appointed acting lieutenant. In 1822–3 he served under Porter against the West Indian pirates, and in 1825 was commissioned as lieutenant. In 1826 he served on the receiving ship *Alert*, on which he conducted a school for the midshipmen; was on the *Natchez* in the harbor of Charleston, S. C., during the Nullification excitement of 1833, and in 1841 was commissioned as a commander.

During the Mexican War (1846–8) Farragut commanded the *Saratoga* in Com. M. C. Perry's squadron. In 1850, with four other officers, he prepared a volume of ordnance regulations for the Union navy, and in 1854–8 was in charge of the Mare Island Navy Yard, Cal., which he established. On the outbreak of the Civil War, though a Southerner, he adhered to the Union, and, leaving Norfolk, Va. (April 19, 1861), where he had been stationed, removed to Hastings-on-the-Hudson. In December 1861, he was chosen to command the important naval expedition against New Orleans. On Jan. 9, 1862, he was formally placed in command of the Western Gulf Blockading Squadron. The defences of New Orleans consisted principally of two forts —Fort Jackson and Fort St. Philip—on opposite sides of the Mississippi River at Plaquemine Bend. On April 16 Farragut's fleet anchored just out of range of these forts, which from the 18th to the 24th were vigorously bombarded, but were not seriously disabled by the mortar flotilla under Porter. Farragut then, in spite of the obstructions in the river and of the heavy fire from the forts, ran by these forts early on the morning of April 24th, with the loss of only one vessel. The Confederate flotilla of 13 gun-boats and 2 iron-clads above the forts was then overcome; New Orleans was forced to surrender (April 27), and on the 28th the two forts surrendered to Porter. (See NEW ORLEANS, BATTLES OF). Farragut then proceeded up the river, successfully ran past the batteries of Vicksburg (June 28), again passed them (July 15), engaged in blockade duty for several months, and in the spring of 1863 co-operated with General Banks in the operations against Port Hudson, which surrendered on July 9. On Aug. 5, 1864, he won the important battle of Mobile Bay. (See MOBILE BAY, BATTLE OF.) He was successively made a rear-admiral (July 1862), a vice-admiral (December 1864), and an admiral (July 1866), receiving all three grades by special acts of Congress. After the war he commanded the European Squadron (1867–8). He died at Portsmouth, N. H., on Aug. 14, 1870, and was buried in Woodlawn Cemetery, N. Y. Consult the *Life* by his son, Loyall Farragut, and that by Mahan in the 'Great Commanders Series.'

Far'rand, LIVINGSTON (1867–), American educator, was born in Newark, N. J. He was graduated from Princeton in 1888, in medicine from Columbia in 1891, and studied also at Cambridge University and in Berlin. He became instructor in psychology at Columbia in 1898, was made adjunct professor in 1901, and was professor of anthropology from 1903 to 1914. He was president of the University of Colorado from 1914 to 1919, when he accepted the chairmanship of the Central Committee of the American Red Cross. In 1921 he became president of Cornell University. During the World War (1917–8) Dr. Farrand served under the International Health Board as director of tuberculosis work in France.

Far'rant, RICHARD (fl. 1564–80), English composer of church music and organist of St. George's Chapel, Windsor. His name is associated with the anthem *Lord, for Thy Tender Mercies' Sake*, though it is probably not his work. Two anthems, however, usually sung on Maundy Thursday, and *Farrant's High Service* (morning and evening) attest his musical genius.

Farrar, far'är, FREDERIC WILLIAM (1831–1903), English divine and author, was born in Bombay, India. After taking orders, he became an assistant master at Harrow. In 1871 he was appointed headmaster of Marlborough; in 1876, canon of West-

minster and rector of St. Margaret's; in 1883, archdeacon, and in 1895, dean of Canterbury. Dean Farrar's literary works include *Eric, or Little by Little* (1858; new ed. 1899); *Julian Home* (1859); *Seekers after God: Seneca, Epictetus, and Marcus Aurelius* (1869); *Witness of History to Christ* (Hulsean Lecture for 1870); *The Life of Christ* (1874); *Eternal Hope* (new ed. 1892). This last-named work, being an attack on the doctrine of eternal punishment, caused much discussion, and modified in a measure current theological beliefs. Among his later works are *Early Days of Christianity* (1882) and *Lives of the Fathers* (1889). Dean Farrar's style was perhaps over-florid, but his eloquence and power of graphic description rendered him popular.

Farrar, GERALDINE (1882–), American soprano singer, was born in Melrose, Mass., and received her musical education in Paris and Berlin. Her début was made as Marguerite in *Faust*, in the Royal Opera House, Berlin (1901), at which time she joined the Berlin Royal Opera. From 1906 until 1922 she was a member of the Metropolitan Opera Company, New York City, her rôles including Marguerite, Butterfly, Manon, Micaela, Mignon, Elizabeth, Tosca, Zerlina, Zaza, Louise, Juliet, Gilda, Violetta, and Carmen. In 1916 she married Lou Tellegen, actor, whom she divorced in 1922.

Farren, far'en, ELIZABETH, COUNTESS OF DERBY (*c.* 1759–1829), English actress, was born in Cork. She made her London début at the Haymarket, in 1777, as Miss Hardcastle in *She Stoops to Conquer*, and the following year played at the Drury Lane, where in 1782 she succeeded Mrs. Abingdon as leading lady. She was married in 1797 to the Earl of Derby. Among her best impersonations were Lady Townly in *The Provoked Husband*, Lady Betty Modish in *The Careless Husband*, Lady Teazle in *The School for Scandal*, and Lydia Languish in *The Rivals*.

Farren, HENRY (*c.* 1826–60), English actor, was born probably in London. He made his first appearance about 1847 at the Haymarket, playing Charles Surface to the Sir Peter Teazle of his father, William Farren. After 1855 he made his home in rhe United States. Among his favorite rôles was Claude Melnotte in *The Lady of Lyons*.

Farren, WILLIAM (1786–1861), English actor, was born in London, the son of an actor of some reputation, and made his first appearance at the Theatre Royal, Plymouth, in *Love à la Mode*. He later went to Dublin, and thence to London, where in 1818 he appeared at Covent Garden as Sir Peter Teazle, one of his best rôles. He acted at Drury Lane in 1828–37, returned to Covent Garden, and later became manager of the Haymarket, the Strand, and the Olympic. Among his best impersonations were Sir Andrew Ague-cheek, Sir Anthony Absolute, Grandfather Whitehead, Kent in *King Lear*, and Old Parr.

Far'rer, EDWARD (1850–1916), Canadian journalist, was born in Castlebar, Ireland. He was educated for the priesthood, but went to Canada in 1870, joined the editorial staff of the *Daily Telegraph*, Toronto, and was later connected with the *Mail* and with the *Times* and the *Sun* in Winnipeg. After his retirement from active journalism in Canada in 1892 he was a frequent contributor to magazines and was Canadian correspondent of the London *Economist*. He is principally remembered for his expressed conviction that 'political union with the United States is the manifest destiny of Canada.'

Far'rier, one who shoes horses, especially a soldier appointed by the troop commander for this duty.

Farrukhabad, fä-rŏŏk-hä-bäd', FURRUCKABAD, or FARUKHABAD, city and district, United Provinces, India. The city is situated on the right bank of the Ganges, 90 miles northwest of Lucknow. It has a good trade in tobacco and fruit. The district has an area of 1,683 square miles, and forms part of the Doab. Pop. (1921) district, 865,633; town, (1931) 60,354.

Fars, färs, or FARSISTAN, the mediæval name of Persia, now applied to the province lying northeast of the Persian Gulf. The coast is low and hot, but inland the surface rises 7,000 to 10,000 feet. In the eastern part is the great salt lake of Bakhtegan. The principal rivers are the Shapur, Tab, and Bendemir. Tobacco, opium, and fruits are produced, and attar of roses, wine, woollen, cotton, and silk goods are manufactured. The capital is Shiraz, and the port is Bushire. Fars contains the ruins of Persepolis and Pasargadæ. Pop. (est.) 750,000.

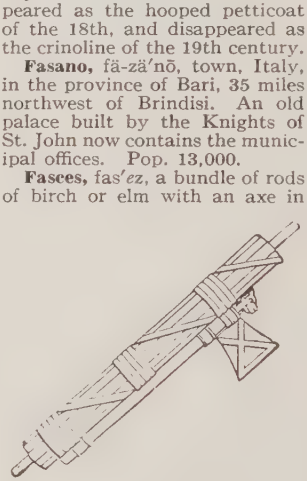
Farsan Islands, fär-sän', a small group of islands in the southeastern part of the Red Sea, off the coast of Yemen. They are centres of pearl fishing.

Far'thing, a small English coin equal to a fourth of a penny. The old silver penny was deeply impressed with a cross and, being broken, made four farthings. Later silver farthings were coined, but in 1672, during the reign of Charles v., these were replaced by copper pieces. They are now made of bronze.

Far'thingale (Old Fr. *vertugalle*, from Span. *verdugardo*, 'a hooped petticoat'), a hooped cage worn under the petticoat. The garment is presumably of Spanish origin, and appeared in France in 1530, and in England during Elizabeth's reign. It became later the monstrous 'wheel farthingale,' with spokes radiating from the waist, giving the wearer the appearance of standing in a drum. Disused in the days of Charles II., it reappeared as the hooped petticoat of the 18th, and disappeared as the crinoline of the 19th century.

Fasano, fä-zä'nō, town, Italy, in the province of Bari, 35 miles northwest of Brindisi. An old palace built by the Knights of St. John now contains the municipal offices. Pop. 13,000.

Fasces, fas'ez, a bundle of rods of birch or elm with an axe in



The Roman Fasces

the middle, carried before the ancient kings of Rome, and later before the consuls, by each of twelve lictors. The rods signified the power of punishment generally, the axes that of capital punishment in particular. When, in 508 B.C., the law of Valerius Publicola deprived the consuls of the power of life and death, the axes were removed from the fasces, except when the consuls were outside Rome and commanding the army, in which event they exercised full power. The fasces containing the axes were always carried before dictators. The prætors were also attended by lictors bearing the fasces—in Rome by two lictors, without axes; abroad by six, with axes. A victorious general, saluted as Imperator, was accompanied by fasces crowned with laurel.

Fascia, fash'i-*a*, in anatomy, the dense fibrous tissue which forms aponeuroses, tendons, and the sheaths of muscles and other parts. The superficial fascia connects the skin loosely with the underlying organs, allowing of free movement of the integument; and as it contains considerable fat in its meshes, it assists in retention of body heat. The deep or aponeurotic fascia is dense, fibrous, and inelastic. It provides sheaths for the muscles

and broad surfaces for their attachment, sending prolongations known as intermuscular septa between them. In older surgical works the term fascia is often employed with its original Latin significance of 'bandage.'

Fascia, or FACIA, a narrow flat band, one of three, in buildings of the Ionic and Corinthian orders. Its position is immediately over the capital of the column.

Fasciation, a mal-formation of plants due to the flattening of a single stem or branch or to the union of several neighboring pedicels.

Fasciolaria, a genus of gastropods whose members have large, spindle-shaped, handsomely colored shells, often called tulip-shells. One species, *F. gigantea,* from South Carolina, has a shell two feet long.

Fascism, fă'shizm, from Italian *fascio* (bundle) and Latin *fasces* (q.v.), a political term denoting the governmental system of Italy. The name *Fascisti* was first adopted by the members of a patriotic organization founded in 1919 and directed by Benito Mussolini (q.v.), at that time editor of *Il Popolo d'Italia.* The movement started in Milan and its adherents were mainly veterans of the World War.

Fascism is largely the consequence of postwar hysteria and political and economic weakness and dissatisfaction. Italy came out of the World War at a poor end of the Versailles bargains. She had felt that participation in the War would enhance her national prestige and improve her economically. Neither anticipation was fulfilled. At home the radicals, particularly the Communists, were gaining in strength. Indeed, the country stood on the brink of revolution. Feeble ministries reshuffled their cabinets without alleviation of domestic chaos. War veterans were amenable to a political theory that was basically patriotic and nationalistic, and at the same time aimed to secure their economic well-being. The World War and the resultant treaty had given them cause to distrust internationalism and the dreams, then current, of an international commonwealth. D'Annunzio's spectacular and finally abortive seizure of Fiume (q.v.) aroused and fed the flames of this nationalistic feeling in the winter of 1919–20. The following autumn the government sanctioned Communist control of factories in the metallurgic regions, and once again the soldiers felt that they had real cause for complaint.

Mussolini, a former Socialist who had fought in the war and had been wounded, began advocating in his journal political and economic theories that combined, in an illogical mixture, syndicalism, socialism, and mystical nationalism. A man long practised in the uses of operatic gesture and blunt oratory, well aware of their effect on the masses, he merged local units of veterans and irresponsible youths into one large political organization. Adopting the fasces as its symbol and the black shirt as its uniform, this organization attracted all the dissatisfied elements of the population, whose political creeds had theretofore been undefined, together with those radicals who had been disillusioned by the abuses of the Communists. Later, when Mussolini's reactionary and conservative side was exhibited, he was also able to attract monarchists and capitalists. The Black Shirts instituted new methods of suppressing the opposition, such as the use of castor oil, which was administered to recalcitrant radicals who threatened to prove a barrier to the Fascist advance. Local organizations of Communists and Socialists were broken up. Radical meeting halls and newspaper plants were destroyed, strikes were broken, while the futile liberal government did nothing.

In retaliation, the radicals called a general strike for August 1921. With clubs and guns the *Fascisti* forced the workers to return to their jobs or took the places themselves. Thereupon thousands of workers deserted the Communists and joined the new movement. By this time a major political force, Mussolini's party was offered, by way of conciliation, a few portfolios in a coalition cabinet. Mussolini rejected the offer, saying that he would not reach power through "the servants' entrance" or be content with a "miserable dish of ministerial lentils." He would have full control or nothing. Indeed, he more than intimated that he would seize power if it were not given him. Then began the highly publicized march on Rome, which for Mussolini was not a march but a ride. The Facta cabinet, which had never arrived at any satisfactory unity, resigned. The king in desperation commanded Signor Salandra to form a coalition government. When Mussolini refused his support, Salandra relinquished his attempt, and the king thereupon called upon Mussolini. His first ministry was relatively moderate, given the extravagance of his initial claims. However, Mussolini gradually increased his power. Italy became, under his leadership, a totalitarian, one-party state. Parliament was dissolved on Jan. 25, 1924. Mussolini became absolute dictator, and symbol of the power of the state. Through lean and difficult years, Mussolini increasingly demanded of the western world the right of territorial expansion. His armies invaded Ethiopia (q.v.) Oct. 3, 1935, and conquered it, despite half-hearted opposition by the League of Nations. In April 1939 a like conquest of Albania was undertaken, and met with only the feeblest resistance. In June 1940 Mussolini led his people into a second World War, this time on the side of Germany.

Conditions similar to those that prevailed in postwar Italy assisted the spread of the nationalistic-totalitarian idea to other countries. In Germany (q.v.) the National Socialists (Nazis) came into power under Adolf Hitler in 1933. Austria, Hungary, Norway, Denmark, The Netherlands, France, Poland and Czecho-Slovakia were, as a result of Nazi aggression, to all intents Fascist in 1940. Spain under General Franco (q.v.) became Fascist in 1939 after one of the bloodiest civil wars in history.

Economic Organization.—Immediately after the Fascist Government came into being, Oct. 1922, important legislation governing trade unions and professional organizations was enacted. These laws regulated the relations of employer and laborer. As a result Italy was no longer a "liberal" democracy. It became a "guild state." The law guiding the policy of this new legislation was enacted April 3, 1926. It provides the legal pattern by means of which employers, industrial and agricultural workers, the trades, and the professions secure representation. Each category of employers and workers is, under this law, permitted to form "syndical associations," which are organized to protect the economic, social, cultural, and spiritual interests of the members. The actions, rights, and enterprises of these associations are held subordinate to the supreme rule of the state, which alone is judge, in the person of the dictator, of the limits of associational activity. In addition, the associations may never become affiliated with organizations which are international in character. The associations represent the category of employers or workers for which they were organized. They serve as policy shapers in wage-stipulations and labor court disputes. They nominate board, council, and commission members who, in turn, through a multiplicity of agencies, make up the corporate state. The stipulations of the associations are the final word in matters pertaining to wages, hours, and conditions of work. Every employer and worker is

Courtesy, Italian Tourist Information Office

MUSSOLINI, DICTATOR OF FASCIST ITALY

required to abide by the findings and agreements of the associations. The membership is open to all Italian citizens who have arrived at the age of eighteen. Though the associational acts are binding on all, actual participation is voluntary. Disputes are settled by regularly constituted courts of arbitration. Strikes and lockouts are outlawed.

Under this system the state is supreme. It purports to be the expression of national will, the sum of all the minute parts which compose the complex of national society. Benito Mussolini described the theory thus: "All within the state, nothing outside the State, nothing against the State." The syndical associations aim at the actual achievement of this political, economic, social, and cultural doctrine. At first the associations were mixed — employers and workers in the same groups; but the law of 1926 recognized the necessity for separation and set up a system of parallel associations, operating under the authority of the Ministry of Guilds. The guilds or associations are organized into larger units under the guidance of two principles: the geographical and the occupational. The associations of a province, district, or zone are grouped together in one large union or confederation. In addition, separate federations are formed to represent and to express the interests and the collective will of the trades, industries, and occupations in the province or district. Less complex and more powerful are the employers' organizations. These are six in kind and are designed to represent owner-interests under the following heads: Industry, Agriculture, Commerce, Banking, Land and Inland Water Transport, and Sea and Air Transport. Management of enterprises in these categories remains in the hands of the owners, subject to control by the state. Labor is protected by the so-called Labor Charter which asserts the limits of power beyond which the employer cannot go and describes the conditions involved in the laborer's status. Conflicts can only be settled by regularly constituted courts. The latest available figures indicate that nearly 85% of employers and approximately 90% of the workers are members of the Fascist associations.

Fasher. See EL-FASHER.

Fash'ion, in a general sense the most widely accepted or highly favored mode in dress, manners, speech, occupation, pursuit, or even manner of thought. Dress, perhaps, affords the most striking and tangible instances of the reign of fashion.

In the East fashion has altered little since time immemorial—difference in clothing there denoting merely difference in rank. To the evolution of dress, and, therefore of fashion, in Western countries, innumerable influences have contributed. The ancient Briton fashioned his garments of skins, with leggings or *braccæ*, the original breeches. In Roman times the skin coat became a tunic and later a doublet, which continued with little variation till it further developed into the prototype of the modern coat and waistcoat. The Romans introduced the toga, still surviving as the cloak in Spain; but this garment was so little suited to the climate of northern Europe that it was discarded. The shirt is of Teutonic origin, and is seen with little variation in the laborer's smock and the blouse of Swiss and French workmen. Boots were adopted after the Saxon conquest, for the Saxon never went barefoot. Gauls covered their heads, a fashion which continued intermittently, the hat or bonnet varying in shape till the steeple crown of the Puritan passed to America, to undergo slight alteration and to be brought again eastward, become fashionable in France through Benjamin Franklin, and develop into the modern tall hat. With the Roman conquest of England came splendor of dress; while under the feudal system the fashion in cut and color differed for each class. Each trade, too, had its peculiar garb—a fashion surviving, with modifications, in the professional dress of barrister and maid.

There was little difference between the long tunic of British and Gallic women and that of Rome.

Fashion tends to revolve in cycles, and to change with more

and more rapidity; this leads to quicker and less excellent production of material, which in turn reacts on fashion. For many centuries Paris set the fashion in women's clothes and London in men's. New York and other large cities now often modify these styles.

The idiosyncrasies of kings and queens, as well as the foibles of prominent men, poets, and others, have set fashions in dress and manners. The Byronic necktie falls into this class. Books likewise have set fashions. Voltaire and Montesquieu, unconsciously, and doubtless much to their amusement, brought about in France a curious imitation of British manners. In a similar manner did Little Lord Fauntleroy collars come into vogue.

Consult G. Hill's *History of English Dress;* A. Challamel's *History of Fashion in France* (Eng. trans.); Planché's *Cyclopædia of Costume;* Robida's *Mesdames nos Aïeules.*

Fashoda, fȧ-shō'*da*, now known as KODOK, town, in the Egyptian Sudan, on the left bank of the White Nile, 470 miles from Khartum.

The Fashoda Affair was a sequel to the reconquest of the Sudan by the British in 1898. The French having occupied the town, British forces under Kitchener proceeded thither from Omdurman in September, 1898. Captain Marchand, the French officer, however, refused to withdraw or to haul down his flag, whereupon Kitchener so disposed his troops as to make the occupying forces virtually prisoners. On Nov. 5, the French government announced their decision to withdraw, and a declaration signed March 21, 1899, brought the incident to a close. France withdrew from the Nile valley, and a new boundary between the British and French spheres was defined.

Fassett, fas'et, CORNELIA ADÈLE (1831–98), American portrait painter, was born (Strong) at Owasco, N. Y. She established herself as a portrait painter in Chicago in 1855, and was elected a member of that city's Academy of Design in 1873. After 1875 she resided in Washington, D. C., where she painted portraits of many prominent persons, including President Garfield, Chief Justice Waite, and Clara Barton. Her best known work is *The Electoral Commission in Open Session* (1880), now in the Capitol at Washington.

Fassett, JACOB SLOAT (1853–1924), American lawyer, born Elmira, New York. He was district attorney of Chemung county 1878–80, a delegate to the Republican National Convention in 1880, served in the State Senate 1883–91, and was secretary of the Republican National Committee for the campaign of 1888. He was unsuccessful candidate for governor of New York in 1891, and served in Congress 1905–11.

Fasti, fas'tē, in early Rome, 'lawful days,' or days on which business might be transacted, as opposed to *nefasti,* on which this was not permitted. Such days were at first proclaimed by the priests, but later were set up in the forum, whence the word became equivalent to 'calendar.' Fasti were of two kinds: the sacred calendars, simply giving the list of lawful and unlawful days, festivals, etc.; and the historical calendars, naming the chief magistrates of each year and its principal events.

Fasting, the abstention, entirely or in part, and for greater or less periods from the use of food and drink. Few human beings have survived absolute abstention from food for as long as twelve days, when water was also withheld. Henry M. Tanner, an American physician, Succi, an Italian, and several imitators are reported to have sustained fasts of forty days, during which water was taken freely, but such cases are unusual.

Observations made during the fasts of Succi and others show that the body wastes less rapidly when the patient is kept warm and at rest. The fatty tissues are the first to be used up, and later the proteids of the skeletal and intestinal muscles. In long-continued fasts the tissues waste more rapidly during the first few days. Later, the body uses its reserves of nourishment more economically. Prolonged fasting is accompanied by grave danger. Fasting in a modified form is sometimes employed as a therapeutic measure.

Religious Fasting.—Fasting, as a religious practice, is of early origin. Partial or entire abstinence from food, or from certain kinds of foods, at stated seasons, prevailed among the Parsees, Hindus, Egyptians, Assyrians (Jonah iii. 5), Greeks, and Romans, and, in fact, the custom was often regarded as an almost essential concomitant of piety and saintliness. It was likewise a prominent element in the religious life of the Jews. The forty days' fasts of Moses (Ex. xxiv. 28) and Elijah (1 Kings xix. 8) are, indeed, spoken of as miraculous experiences rather than as acts of voluntary abnegation, but the Old Testament records several instances of a self-imposed abstinence (1 Sam. vii. 6; 2 Sam. xii. 16; Jer. xxxvi. 9) even before the captivity; while the Day of Atonement, the tenth of the seventh month, was specially set apart as a fast for the whole nation (Lev. xvi. 29, 31). After the return from captivity we find fasts ordained for the fourth, fifth, seventh, and tenth months, intended to commemorate certain calamitous incidents in the downfall of Israel (see Zech. viii. 19, according to which, however, the fasts are to be changed to feasts). By the time of Christ the number of special fasts had still more increased.

Christ Himself lays down no express rules as to fasting, but the church, influenced probably by passages like Matt. ix. 14–17, early commenced to institute seasonal fastings for its members. In the Roman Catholic Church there are the great fast of Lent, the quatember fasts of three days in one week recurring four times a year, and Friday's abstinence from flesh foods. In the Greek communion the fasts cover about three-quarters of the year, and are rigorously observed. Among the Anglicans and Protestants generally the custom is regarded as praiseworthy rather than obligatory, but the Prayer Book enumerates the forty days of Lent, the Ember days, the Rogation days, and the evenings or vigils before certain festivals, as statutory seasons of abstinence. In some New England States an annual 'Fast Day' is observed, a custom of Puritan origin.

See also MOHAMMEDANISM; RAMADAN.

Fast'net Rock, islet off the southwest coast of Cork, Ireland, 4½ miles southwest of Cape Clear. Its revolving white light is visible for 18 miles.

Fastolf, or FASTOLFE, SIR JOHN, a Shakespeare character. See FALSTAFF.

Fat, a substance of both animal and vegetable origin, white, greasy, and melting easily. (See OILS.) Chemically, fats and oils, whether derived from animals or plants, are hydrocarbons, consisting approximately of 79 parts of carbon, 11 of hydrogen, and 10 of oxygen. The three principal fats are stearin, palmitin, and olein; but in nature no one of these is found alone, all natural fats and oils being mixtures of two or three simple fats or compounds of glycerin with fatty acids. Animal fat consists of oil globules contained in thin envelopes, and varying in composition not only in different animals but in different parts of the same animal. Vegetable fats occur in many plants, chiefly in the seeds. Thus some nuts contain over 50 per cent. of oil. Of the ce-

reals, oats, with 6 per cent., are richest in fatty substances. The fat of the living body is derived chiefly from the hydrocarbons of the food, but also from the albuminates and carbohydrates, so that in health, should a greater quantity of any carbon-containing food be taken than is required for the daily needs of the body, the excess may be stored up in the form of fat. (See DIGESTION.)

As a food, fat produces, by rapid oxidation, both heat and energy, and it can be taken much more freely in cold than in warm climates. Excessive adipose tissue may by weight and pressure seriously affect the heart and other organs. A pathological deposit of fat in highly specialized cells is known as 'fatty degeneration.' It is caused by various wasting diseases, such as pernicious anæmia, and occurs also as a result of senility; while various poisons, such as phosphorus and alcohol, produce it. Where, as often happens, the process occurs in the cardiac muscle, death frequently ensues in the early stages of the degeneration, the weakened heart being no longer able to carry on its work. To cure obesity various methods of treatment have been advocated. Probably exercise is the best and safest, but much may be done in addition by dieting. The hydrocarbons and carbohydrates should be given in less, and the proteids of the food in greater, quantities than the body requires for daily use, so that each day part of the stored-up fat is drawn upon. The excess of proteids prevents a too rapid diminution. Fluids should be given only sparingly, and should be withheld at meals. Drugs are of little service in the condition. (See OBESITY.)

Fat is useful in the preparation of other foods. As it can be heated to a temperature of 500° F. without boiling, it is employed in cooking fish and meat. There should be sufficient oil to allow of the immersion of the article to be cooked, and the temperature should be at least 300° F. By this means a thin film is coagulated on the surface of the food, and the escape of its nutritious juices is prevented. See OILS and FATS.

Fatalism signifies the belief that the issue of all events is so fixed or predetermined by fate or divine decree that no effort of man can avail to alter it. In relation to human life and action fatalism is thus an extreme and external form of determinism, which must be clearly distinguished from determinism properly so called (see DETERMINISM) since it not merely regards the events of man's life as determined, but deprives man's active will and effort of any effective part in their determination. In religion and theology, to which the doctrine of fatalism more properly belongs, it may be regarded as the expression, in an abstract and therefore defective and misleading form, of a genuine religious conviction—*viz.* that of the sovereignty of God—the form of expression being abstract and imperfect because it ignores or conflicts with the facts of man's moral agency.

Fata Morgana, fä-tä môr-gä'nä, the Italian name for a striking mirage observed in the Strait of Messina. The mirage is often duplicated, one image being inverted.

Fatehgarh, fut-eh-gur', town, United Provinces, India, capital of the district of Farukhabad, 3 miles southeast of Farukahabad. It has a government gun-carriage factory. In 1857, during the Indian mutiny, the entire European population was massacred. Pop. 13,000.

Fatehpur, fut'eh-pŏŏr, town, United Provinces, India, capital of Fatehpur district; 70 miles northwest of Allahabad. It contains two interesting mosques and has a trade in grain. Pop. 15,000.

Fatehpur-Sikri, town, United Provinces, India, 23 miles west of Agra. It was the former capital of the Mogul empire, founded by Akbar in 1570, but is now in ruins, of which the tomb of Selim Chisti is one of the most magnificent in India. The modern town lies to the southwest of the ancient city. Pop. 5,000.

Fates. See MOIRÆ.

Father. See FAMILY.

Fatherhood, THE DIVINE. Fatherhood is the simple yet sublime metaphor used to express the distinctively Christian view of God in His relation to man. Partial anticipations of the conception are found in ethnic religions, but these hardly go beyond the idea of God as the progenitor of all things. In the Hebrew Scriptures, God is sometimes called father (Isa. cxiii. 16), and the Israelite nation is spoken of as His son (Hos. xi. 1; *cf.* Ps. ciii. 13), but the thought is largely vitiated by its narrowness in excluding the Gentiles from the privilege. The new and unique feature in the teaching of Jesus on the subject is that with Him the idea of God's fatherhood becomes the key to all His dealings with men, and while He vastly enriches the idea, He excludes none from its embrace (Luke vi. 35). True, there is a sense in which believers specially are the children of God (*cf.* the phrase, 'your Father,' Matt. vi. 26, etc.), and which is developed in the apostolic writings (1 John iii. 1), and particularly by Paul under the figure of adoption. It should be noted that Jesus draws a distinction between His own relation to God and that of others (*cf.* 'your Father,' 'my Father'; never 'our Father,' as embracing both). He is in some manner the only-begotten, while we are sons by adoption.

Fathers, APOSTOLIC. See APOSTOLIC FATHERS.

Fathers of The Church, a name under which are included those authors of the early Christian centuries who are recognized as high authorities in matters of the Church's faith; in brief, the ancient classics of Christian theology. The principal qualifying characteristic of any particular writer included in the class would seem to be that, as an expounder or defender of Christian doctrine, he was in agreement with the essential teaching of the Church. This excludes, for example, Apollinaris, as a heretic pure and simple, and Eusebius of Cæsarea and Socrates, as rather *scriptores ecclesiastici*, but admits others—*e.g.* Origen, whose works were regarded by some with considerable suspicion. As to the lower limit of the so-called patristic period, the Roman Catholic Church sometimes regards Bernard of Clairvaux (d. 1153) as the last of the fathers, while the Greek Church prolongs it till the Council of Florence (1441); but it is most convenient to bring the age of the fathers well within the first period of church history, say from 100 to 700 A.D. Excluding the apostolic fathers, we may enumerate the fathers proper thus: (1) Ante - Nicene writers—Irenæus, Tertullian, Justin, Origen, Clement of Alexandria, Cyprian, and Gergory Thaumaturgus, of whom the second and sixth wrote in Latin, the others in Greek; (2) post-Nicene writers—Athanasius, Basil, Chrysostom, Gregory Nazianzen, Cyril of Jerusalem, Gregory of Nyssa, Epiphanius, Cyril of Alexandria, pseudo-Dionysius, and Joannes Damascenus, all writing in Greek, and Ambrose, Jerome, Augustine, Gregory the Great, Hilary, and Leo the Great, in Latin. The first four named in each section of the post-Nicene authors are specially recognized as the *doctores ecclesiæ* in the Greek and Roman Catholic Churches respectively.

In regard to the regulative authority of these writers, the Church of Rome makes a distinction between their function as witnesses of the faith and their actual work as instructors. So far as concerns the former, they are of course unanimous, and their writings contain that in-

fallible tradition of truth which it is heresy to gainsay; in respect to the latter, they have their idiosyncrasies and individual opinions, which are in no way binding. The Protestant view, while admitting a *consensus patrum*, and the undoubted value of their writings, is that they have no unimpeachable authority, either singly or conjointly, but must be judged and used as other human writings. The study of the fathers is called patristics or patrology. Collective editions are J. P. Migne's, in 383 vols. (1844 *seq.*); *Nicene and Post-Nicene Fathers* (1st ser., 14 vols., 1887–92; 2d ser., 14 vols., 1890–1900).

Father's Day, the third Sunday in June, is quite generally observed as a day to do honor to fatherhood. The idea was conceived about 1910, but it is only within the last five or six years that there has been any general observance. Delaware was the first State to take action, designating the day as the first Sunday in June in a special charter. Congress indorsed a resolution in 1914 to make Fathers' Day a national observance day, but the war prevented any further action. But after the war the movement was revived without legislative help, and 1922 witnessed the first country-wide celebration of national proportions, which occurred on the third Sunday in June, a day which has been fixed annually ever since.

Fathom, fath'um, a measure of six feet, used for regulating the length of a cable and to divide the sounding line. The meter is largely used in Italy, Austria, Hungary, Germany, Spain, and Portugal, as well as in France. In the United States and British charts, soundings are usually marked in fathoms, though, in the case of shallow water, feet are employed.

Fatigue, fa-tēg', in physiology, the flagging or fatigue of muscle which largely depends on the poisoning of the muscle cells by their own waste products. If the muscle is washed with blood or with salt solution its energy is in great measure restored. The unsheathed end-plates of nerves yield to fatigue even sooner than do muscle cells, and, like them are poisoned by muscular waste-products. The central sensory and motor nerve cells display similar phenomena. In the living tissues anabolism—the building up of the complex molecule—is constantly going on, but not so quickly as to keep pace with the katabolic or destructive changes which result from rapidly repeated stimuli. When the katabolic processes have outrun the anabolic up to a certain point, and when some degree of waste-product poisoning has been produced, there is, to ordinary stimuli, an irresponsiveness which we know as fatigue. In diseases which accelerate the heart's action, both its muscle and its nerve cells speedily exhibit fatigue.

In *materials,* the term is used to denote the weakening effect produced (chiefly in metals) by a repeated succession of severe stresses. Thus, an iron girder, which would withstand a steady load equivalent to a stress of twenty tons per square inch of sectional area of the metal, has been found to break after the five-hundredth application of a load equal to a stress of only ten tons per square inch. On the other hand, a stress of five tons per square inch might be imposed and removed indefinitely without injurious effects, the resultant strain being small compared with the elasticity of the metal. A member of machinery, such as a piston-rod, which is alternately in compression and tension, is, if highly stressed, also liable to fatigue. This is supposed to be the result of a molecular change in the metal, due to vibration or a continually varying strain.

In military usage the term is applied to a soldier's work when not connected with the use of arms—*e.g.* fatigue-duty. Similarly, fatigue-dress is the uniform worn when so engaged.

Fatimah fä'tē-mä, or Fatima, (600–632), a daughter of Mohammed by his wife Khadija. She is one of the four perfect women of Islam, and married Ali.

Fatimides, fat'i-midz, an Arab dynasty which reigned over Egypt, North Africa, and Syria, from 909 to 1171 A.D. Its founder claimed to be descended from Fatimah, the daughter of Mohammed, and wife of Ali. The first ruler of the family, Ubaid-Allah, surnamed Al-Mahdi 'the guided one' (822–934), ascended the throne in 909. During his reign he extended his empire over nearly the whole coast of North Africa, and penetrated into Italy and Sicily. He was succeeded by Al-Quaim (934), who took Genoa, and sent a piratical expedition against Sardinia; but at the end of his reign he was deprived of the greater part of his kingdom by Abu Yazia, a religious enthusiast and capable soldier. Al-Mansur (945) regained the lost dominions, whilst Al-Muiz (952), by waging a successful war with Spain, and by becoming master of Sicily, and Egypt, where he founded Cairo, which became his residence and that of his successors, raised the dynasty to the highest pinnacle of fame. Al-Aziz (977) firmly established his power in Palestine and Syria.

His successor, Al-Hakim (996), the founder of the religion of the Druses, was a fanatic of capricious temper, who alternately favored and persecuted the Jews and Christians. After his assassination he was succeeded by Al-Zahir (1020), who, although not addicted to his father's follies, was unable to arrest the decline which was now rapidly setting in. Under Al-Mustanzir (1036), who was seven years old when he commenced to reign, and occupied the throne for sixty years, parts of Syria and Palestine as well as Sicily were lost. Al-Mustali (1094), who was the creature of his capricious vizier, reconquered Jerusalem; but it was shortly after taken from him by the victorious crusaders. Al-Amir (1101), Al-Hafiz (1130), Al-Zafir (1149), and Al-Faiz (1154), were mere ciphers on the throne. The last of the dynasty was Al-Azid (1160–71). The disturbances in Egypt during his reign, caused by two men contending for the vizierate, brought about the downfall of the Fatimides. The victorious general, Shirkuh, whose aid had been solicited in the first instance by one of the rival candidates, was appointed vizier, to be succeeded, after a very short tenure of office, by his nephew Saladin. At the death of Al-Azid, Shirkuh's nephew was proclaimed as the head of the new dynasty, the Ayubites. Consult Poole's *Mohammedan Dynasties.*

Fatshan, fut-shän, or Fuh-shan, town, China, in Kwangtung province, on the West River; 10 miles southwest of Canton. It is a busy manufacturing and commercial centre, known as 'the Birmingham of China,' and produces silk, porcelain, embroideries, iron and steel goods, paper and brass ware. Pop. 500,000.

Fatsia, fat'si-a, a genus of half-hardy shrubs belonging to the order Araliaceæ. The most important species is the *F. papyrifera* of Formosa, the source of the celebrated rice paper of the Chinese. This is a shrub growing to about eighty feet in height, with large heart-shaped leaves upwards of a foot in length. The young leaves are hoary, but the old leaves are usually free from down. It bears drooping clusters of small greenish-white flowers. The rice paper is a preparation of the pith which fills the stem.

Fatty Acids, a series of saturated hydrocarbon derivatives, having the general formula $C_nH_{2n+1}COOH$, in which the carbon atoms are arranged in open chains. Fatty acids are in general prepared either by the oxida-

tion of the corresponding alcohols or by the hydrolysis of the alkyl cyanides; thus, acetic acid is obtained, as in the manufacture of vinegar, by the oxidation of ordinary alcohol, and propionic acid by boiling ethyl cyanide with dilute acid or alkali.

The lower members of the series—formic acid, HCOOH, acetic acid, CH_3COOH, propionic acid, C_2H_5COOH—are sharp-smelling, very sour liquids that are volatile and freely soluble in water. The next members—butyric acid, C_3H_7COOH, valeric acid, C_4H_9COOH, etc.—are more oily, less volatile and soluble, and have an unpleasant as well as sour smell; whilst the higher members, such as palmitic acid, $C_{15}H_{31}COOH$, and stearic acid, $C_{17}H_{35}COOH$, are odorless solids of a waxy nature, used for making candles, and of which the sodium and potassium salts are the soaps, and glycerol esters the common fats, from which the name of the series is taken. The fatty acids are monobasic, and exhibit isomerism amongst the higher members.

Fatty Compounds comprise the paraffin series of hydrocarbons, of the general formula C_nH_{2n+2} and their derivatives, and are distinguished by having the carbon atoms present in them arranged in open chains. They get their name from the fact that the common fats are included in their number.

Faucher, LÉON (1803–1854), French politico-economical writer, born at Limoges. After the revolution of 1830 he edited and contributed to *Le Temps*, *Le Constitutionnel*, etc., and was one of the first to sign his articles. A leading authority on economic topics, he advocated free trade, and published *Etudes sur l'Angleterre* (1845). He sat in the Assembly from 1846, and for a time (1848) was minister of the interior under Napoleon III. He also wrote *Recherches sur l'Or et sur l'Argent* (1843), and other works published in part as *Mélanges d'Economie Politique et de Finance* (1856). See *Life*, in French.

Fauchet, CLAUDE (1529–1601), French antiquarian and historian, was a protégé of Henry IV., by whom he was appointed historiographer of France. He composed several works on early French history and the origin of the French monarchy and institutions, important for their matter, but written in a rude and barbarous style. The chief of these are *Antiquitēz gauloises et françoises* (1579), and *Origines des Dignitēz et Magistrats de France* (1600).

Faucit, HELENA SAVILLE, afterwards LADY MARTIN (1820–98), English actress, made her début at Covent Garden in 1836 as Julia in *The Hunchback*, and rapidly reached the first position in Macready's company. With him she played at Drury Lane with brilliant success in 1842–3. After playing for eight years more in London and the provinces, she married, in 1851, Mr. (afterwards Sir) Theodore Martin, but continued to act until 1871, when she retired. By far the greatest actress of her time, Helena Faucit achieved success in characters of very varied types. Almost unrivalled as Lady Macbeth, she was a Juliet of surpassing charm, a Rosalind of delightful archness and grace, and an Antigone of tragic strength. Among the parts which she created were La Vallière in Lytton's *Duchess de la Vallière* (1836), Pauline Deschapelles in his *Lady of Lyons* (1838), Lucy, Countess of Carlisle, in Browning's *Strafford* (1837), and Mildred Tresham in his *Blot on the 'Scutcheon* (1843). She wrote *On Some of Shakespeare's Female Characters* (1885). See *Biography* by Sir Theodore Martin (1900), and *Actors and Actresses of Great Britain and the United States*, ed. by Matthews and Hutton (1886).

Faulhorn, famous view-point (8,803 ft.) in the Bernese Oberland, Switzerland, between the valley of Grindelwald (to the S.) and the Lake of Brienz (to the N.). In 1832 a hotel was built on the top, which is accessible from Grindelwald by horse track, and is now much visited in summer.

Faulkner, CHARLES JAMES (1806–84), American politician, born in Berkeley co., Va. He served several terms in the Virginia legislature, where, in 1832, he advocated emancipation in that state, and in 1848 introduced a bill, which was passed, sent to Congress, and became the framework of the well-known Fugitive Slave law of 1850. He was a member of Congress from 1851 to 1859, in which year he was appointed minister to France, but, for influencing Louis Napoleon in behalf of the Confederacy, was, in 1861, recalled and imprisoned in Fort Warren, Boston. He subsequently served on the staff of Gen. 'Stonewall' Jackson, and was a Democratic member of Congress from West Virginia in 1875–77.

Faulkner, JOHN A. (1857–1931), Amer. educator and author, was born at Grand Pré, N. S., and graduated (1878) at Acadia College, N. S., taking his degree in divinity at Drew Theological Seminary in 1881. He continued his theological studies at Andover, Leipzig, and Bonn, and, entering the Methodist Episcopal ministry in 1883, was pastor of churches in Pennsylvania and New York until 1897, when he accepted a professorship at Drew. He contributed numerous articles on the history of the church to religious periodicals, and published *The Methodists* (1903) in the 'Story of the Churches' series.

Faults, in geology, are fractures which traverse the rocks of the earth's crust. Of the masses on opposite sides of a fault one has been uplifted, the other depressed, and they are in consequence known respectively as the *upthrow* and the *downthrow*. The amount of displacement varies from a few inches up to ten thousand or twelve thousand feet. Faults, as a rule, run in straight or gently-curved lines, and the greater faults can be traced for hundreds of miles. They are especially well seen in regions of coal measures. They often afford free passage upwards for underground water, and may be marked by lines of springs at the surface, or be occupied by deposits of mineral ores. In some cases faults have been injected with igneous rock, forming dykes. Rivers crossing faults are sometimes marked by waterfalls. The Rift Valley of Central Africa is bounded by fault cliffs on each side.

Earthquakes are particularly numerous near great faults, and are believed to be due to sudden slipping of the rocks. Large faults are usually flanked by smaller faults running parallel

Normal Fault.

The similarly shaded strata, A A, show the amount of displacement; F F, fault.

to the main displacement, and faults often occur in groups which branch and may again unite, forming a plexus. The plane of the fault is rarely vertical, but has a certain 'hade' or slope. Normal faults are such as hade towards the side on which the strata have sunk—*i.e.* they 'hade to the downthrow.' This type of fault is commonest in areas where there has not been great folding of the rocks. Reversed faults hade towards the upthrow side; they are principally found in regions of much-folded rocks, though they are not unknown in coal basins. The inclination of the fault planes is

usually more gentle than is the case in normal faults, and they may indeed be nearly horizontal. Where they are very large they are known as 'thrusts.'

Faun. See FAUNUS.

Fauna, the name given collectively to the animal life of any area, whether natural or artificial. Thus we have the fauna of North America, which constitutes a natural collection of animals; or we may have the fauna of a county where the lines of demarcation are wholly artificial.

Faunce, WILLIAM HERBERT P. (1859–1930), American educator, born at Worcester, Mass. He graduated at Brown in 1880, and was instructor in mathematics at that university the following year. He graduated at Newton Theological Seminary in 1884, and for the next five years was pastor of the State Street Baptist Church at Springfield, Mass. In 1889 he became pastor of the Fifth Avenue Baptist Church in New York city, where he remained until he became president of Brown University in 1899.

Faunus, in Roman legend, was the third king of the Laurentes. He was worshipped as the god of shepherds and of agriculture, and also gave oracles. When Greek mythology was introduced into Italy, Faunus was identified with Pan. The name of faun is also given in a general way to statues of any rural god.

Fauquier, FRANCIS (1704–68), colonial governor of Virginia from 1758 until his death. Although sympathizing with the colonial grievances, he opposed action, dismissing the house of burgesses for passing Patrick Henry's Stamp Act resolutions, in 1765, and refusing to convene a new house to send delegates to the Colonial Congress, on invitation of Massachusetts. Otherwise, he was liberal and popular, and a friend of Jefferson.

Faure, FRANÇOIS FÉLIX (1841–99), president of the French republic from 1895 until his death. Born in Paris, the son of a small cabinetmaker, he made a fortune in business at Havre, and was returned to the National Assembly in 1881 as a moderate Republican. The next year he became under-secretary for the colonies, and in January 1895 he was very unexpectedly chosen president of the republic on M. Casimir-Périer's resignation. In 1896 he received the Czar in Paris, and in 1897 returned the visit—occasions on which his tact and *savoir faire* contributed greatly to the successful conclusion of the Franco-Russian alliance.

Faure, JEAN BAPTISTE (1830–1914), dramatic baritone, one of the greatest France has produced. was born at Moulins. He was very successful at the Opera Comique, and, after joining the Grand Opera in 1861, acquired a European reputation by his interpretations in *L'Africaine, Faust, La Favorita, Don Carlos,* etc. When France was disturbed by the war of 1870–71, he appeared in the chief capitals of Europe, and in London made a great impression — chiefly, perhaps, in Gounod's *Faust.* He retired from the stage in 1876, and taught for a time at the Conservatoire in Paris, in which he was made a professor in 1857, and published (1886) *La Voix et le Chant.* M. Faure is also known as a composer of sacred music, his sacred song, *Les Rameaux* (*The Palms*), being a great favorite in the U. S.

Fauriel, CLAUDE CHARLES (1772–1844), French philologist and man of letters, born at St. Etienne; gave himself from about 1802 entirely to scholarship, studying Arabic and Sanskrit. In 1830 a chair of foreign literature was founded for him at Paris, his lectures being republished as *Histoire de la Poésie Provençale* (1847). His other principal works are *Histoire de la Gaule Méridionale* (4 vols., 1836), *Sur l'Origine de l'Epopée du Moyen Age* (1833), and a French translation of modern Greek popular songs (Eng. trans. 1825).

Faust is a name around which many tales of supernatural powers, associated with Simon Magus, Paracelsus, and others, have crystallized. There is a good deal of evidence to show that there lived in the 16th century a Dr. Johannes Faustus. The first allusion to him is found in a letter written in 1507, in which the Abbot Trithemius speaks of him contemptuously as a quack and swindler; the great humanist, Mutianus Rufus, writes in the same strain in 1513. Some contemporaries, on the other hand, have left favorable accounts, and these are now regarded as nearer the truth. Faust appears to have died soon after 1540. The strange stories were first gathered in a chapbook printed by Johann Spies in 1587. Here Faust is described as a man of profound learning, and of great magical powers, obtained by means of a compact with the devil Mephistopheles. He uses his powers to win wealth and worldly delights, and conjures up Helen of Troy, who bears him a son. At the end of the stipulated twenty-four years he is carried off by the devil. This book was very popular. In England the fate of Faust was dramatized very early (about 1589) by Marlowe, and English troupes of actors brought this play to Germany, where it became the source of many puppet plays. Marlowe's *Faustus* craved temporal power. In Goethe's *Faust* (of which the earliest scenes were written before 1775, while the whole was completed shortly before Goethe's death, and published in 1833) he is a man of vast learning, who passes through ever-winding spheres of human life, and who does not attain happiness until his powers are given to the service of mankind; he represents Goethe's own unwearying aspirations towards the ideal. Faust also attracted the 'storm and stress' writers, Friedrich Müller (*Fausts Leben dramatisirt,* 1778) and M. Klinger (*Fausts Leben, Thaten, und Höllenfahrt,* 1791). Grabbe, who has much in common with them, wrote a *Don Juan und Faust* (1829), in which he represents his two heroes as in love with the same woman; they are indeed both Don Juans. Lenau's *Faust* (1836) is a noble work of poignant sadness, a lyric poem rather than an epic drama. Heine characteristically made Faust the subject of a ballet, *Der Doctor Faust, ein Tanzpoem* (1851). *Faust* is the title of operas by Berlioz and Gounod. See works on Faust by F. T. Vischer (1886), Kuno Fischer (1893), O. Pniower (1899), and J. Minor (1901). For the Faust legend, see C. Kiesewetter's *Faust in der Geschichte und Tradition* (1893), and Faligan's *Histoire de la Légende de Faust* (1888). For a bibliography (2,714 items) of all works bearing on Faust, see K. Engel's *Zusammenstellung der Faustschriften* (1885).

Faust, JOHANN. See FUST.

Faustina. (1.) ANNIA GALERIA FAUSTINA (104–141 A.D.), married the emperor Antoninus Pius when he became emperor in 138 A.D.; she received the title of Augusta. (2.) ANNIA FAUSTINA (*c.* 130–175 A.D.), daughter of the above, and wife of M. Aurelius, the emperor. Doubts have been thrown on the accusations of gross profligacy made against both these women.

Favara, tn., prov. Girgenti, Sicily, 4 m. E. of Girgenti; produces sulphur and marble. Pop. 20,403.

Favart, CHARLES SIMON (1710–92), French dramatist, born in Paris, and became director of the Opera Comique before he was forty. Favart and his wife accompanied (1746) Marshal Saxe to Flanders, to superintend a troupe of actors which travelled with the army. After the marshal's death (1750) they returned to Paris, and Favart again took up his playwriting. His best plays are *La Chercheuse d'Esprit* (1741), *Annette et Lubin* (1743), *Ninette à la Cour* (1755), *Les Trois Sultanes* (1761), and *L'Anglais à Bordeaux* (1763). His collected

plays were first published in ten volumes (1763–72), and his *Mémoires et correspondance littéraire* posthumously (1809). Consult *Life* by Font (1894).

Fav'ersham, town and seaport, England, in Kent; 9 miles west of Canterbury. There are remains of an abbey founded by King Stephen and the parish church contains tombs of King Stephen, his wife Matilda, and his son. There are large gunpowder and tonite mills; also cement works and breweries. The oyster fisheries are worked by an ancient guild. Madder was first grown here and at Dartford in 1660. Historically the town dates back as far as the ninth century. Pop. (1921) 10,870.

Faversham, WILLIAM (1868–), American actor, was born in England. He was educated in England and went to the United States in 1888, five years later becoming a member of the Empire Theatre Company of which he afterwards became leading man. He became a star in 1901 and in 1908 appeared under his own management. He is a polished and sympathetic actor and has always enjoyed a high reputation and great popularity. He has played in Shakespearian rôles and is perhaps at his best in drama and tragedy.

Favignana, fä-vē-nyä'nä, one of the Egadi (Ægates) Islands, off the west coast of Sicily. The fishing town of Favignana stands on its northern shore. Off this island the Romans defeated the Carthaginians in 241 B.C. Pop. about 6,500.

Favo'nius, in Roman mythology the name given to the west or southwest wind which blew in spring. It was identified with the Greek *zephyrus*.

Favonius, MARCUS (*c.* 42 B.C.), Roman public man, a contemporary of Cicero and of Cato of Utica, whose stoical habits he copied so closely as to be called 'Cato's ape.'

Favre, fav'r', JULES CLAUDE GABRIEL (1809–80), French statesman, was born in Lyons. He studied for the bar in which profession he had a brilliant career, his reputation being finally established by his defence of Orsini (1858). Entering the Legislative Assembly as one of the five members opposed to the Empire (1860), after the surrender at Sedan (1870) he moved the resolution deposing the Emperor. As minister of foreign affairs under the republic, he advocated desperate resistance to the Germans; and on being sent to negotiate with Bismarck, met the latter's demands with the famous answer, 'Not an inch of our territory, not a stone of our fortresses.' On the termination of the war, and the suppression of the Commune, he retired from political life.

Favus, fā'vus, a skin disease, due to the presence of a fungus (*Achorion schönleinii*). It is highly contagious and exceedingly intractable. In human beings it may occur in any part of the skin, but is most commonly found on the scalp, resulting in loss of hair, or complete baldness if unchecked. It attacks lower animals, and the mouse and the cat are believed to be frequent sources of infection. It is rare in the United States and in England, though fairly common in Scotland. The round, cup-shaped crusts, resembling honeycomb, which are usually situated over hair follicles, have a yellow, cheesy color, and consistency, and a mousy smell. The disease is best treated with x-rays: the hair all comes off, suitable antiseptics can then reach the hair bulbs, and new healthy hair may be expected in a few months.

Faw'cett, EDGAR (1847–1904), American writer, was born in New York City. He was graduated (1867) from Columbia University and until the last few years of his life he lived continuously in his native city, making his summer home in Rye, N. Y. He then removed to London where he remained until his death. He was for the most part a free lance, writing his books of fiction and contributing verse, criticism, essays, and sketches to periodicals according to his moods, but he was for several years a staff-writer for *Collier's Weekly*. He was a member of the National Institute of Arts and Letters. He wrote several dramas, of which *The False Friend* (1880) was the most successful. His volumes of poems include *Poems of Phantasy and Passion* (1878), *Song and Story* (1884), *Romance and Revery* (1886), and *Songs of Doubt and Dream* (1891). His works of fiction deal principally with life in New York, and include *A Hopeless Case* (1881), *A Gentleman of Leisure* (1882), *Social Silhouettes* (1885), *The House at High Bridge* (1887), *Olivia Delaplaine* (1888), *A Mild Barbarian* (1894), *New York: a Novel* (1898), and *Voices and Visions* (1903). In 1889 he published *Agnosticism, and Other Essays*.

Fawcett, HENRY (1833–84), English economist and statesman, was born in Salisbury, Wiltshire. At Cambridge he made the acquaintance of J. S. Mill, who had a decided influence on his career. The loss of his sight by an accident (1858) only increased his intellectual activity. In 1863 he published *Manual of Political Economy*, which led to his appointment to the professorship of political economy at Cambridge in the same year, a post which he held till his death. He entered Parliament as member for Brighton in 1865 as an advanced Liberal, took an independent attitude regarding education in 1870, but was largely instrumental in defeating Mr. Gladstone's Irish University Bill in 1874. During the Parliament (1874–80) he showed so marked an interest in Indian affairs that he became known as the 'member for Hindustan'; and he also advocated the preservation of commons in the interests of agricultural laborers. He became postmaster-general (1880) and introduced several practical reforms, such as the parcels post (1882), and devised many schemes to encourage thrift. His lectures were published as *The Economic Position of the English Laborer; Pauperism: its Causes and Remedies; Free Trade and Protection*, and others. As an economist he was content to be a faithful expositor of Mill. Consult Stephen's *Life of Henry Fawcett*.

Fawcett, JOHN (1768–1837), English actor, who in childhood attracted Garrick's attention, who influenced him to become an actor. He first played tragedy in York and elsewhere in Tate Wilkinson's company, but later was induced to adopt comedy, in which he appeared on the London boards, and by 1800, after a famous interpretation of Falstaff, his reputation was established. He became assistant manager at the Haymarket under Colman, some of whose characters he created; and after over thirty years' close association with Covent Garden, retired in 1829.

Fawcett, MILLICENT GARRETT (1847–1929), English writer, was born in Aldeburgh, Suffolk. In 1867 she married Henry Fawcett, the distinguished economist, and soon became known for her work in connection with the education of women, and the woman's suffrage movement. In 1926 she received the Grand Cross of the British Empire. Her publications include *Political Economy for Beginners* (1870); *Tales in Political Economy* (1875); *Janet Doncaster*, a novel (1875); *Some Eminent Women of our Time* (1889); *Life of Queen Victoria* (1895); *Life of Sir William Molesworth* (1901); *Women's Suffrage* (1912); *What I Remember* (1924); *The Women's Victory and After* (1911–28); *Two Visits to Palestine* (1926).

Fawkes, fôks, GUY (1570–1606), English conspirator, son of Protestant parents, was born in York. He became a zealous Roman Catholic, and served in the Spanish army (1593). Though not consulted in the devising of the Gunpowder Plot, he was

intrusted with the chief part in its execution. The plot was discovered, however, and he was arrested and hanged. See GUNPOWDER PLOT.

Fay, AMY (1844–1928), American pianist and teacher, the daughter of the Rev. Dr. Charles Fay, was born in Bayou Goula, La. She studied music under Tausig and Kullak in Berlin, and under Liszt in Weimar. On her return to America she lived for several years in Chicago, giving lectures and lessons in music, and subsequently removed to New York City. She published *Music Study in Germany* (1881), a naïve description of the worship accorded Liszt by his pupils, which passed through many editions here and abroad.

Fáy, fī, ANDRÁS (1786–1864), Hungarian author and poet, was born in Kohany (Zemplin). He studied law and was admitted to the bar, represented the county of Pest in the Hungarian Diet, and prior to the advent of Kossuth was leader of the patriotic party. He founded the Hungarian National Theatre and the Pest Savings Bank. His later years were devoted to literary pursuits. His *Mesék*, or Fables, was published in 1820, and was well received; and plays, poems, and novels succeeded. Of the last, the best known is *Javor, the Doctor* (1855).

Fay, MORGAIN DE. See MORGAIN DE FAY.

Fay, THEODORE SEDGWICK (1807–98), American author and diplomat, was born in New York City. He entered journalism at an early age, becoming associate editor of the New York *Mirror*, with Morris and Willis, in 1828. He was secretary of the American legation at Berlin from 1837 to 1853, when he was appointed U. S. minister to Switzerland, retiring in 1861, after which year he resided in Berlin. His first book was a volume of essays, *Dreams and Reveries of a Quiet Man* (1832); this was followed by his most popular novel, *Norman Leslie* (1835); other publications include the *Countess Ida* (1840), *Hoboken, a Romance* (1843), *Voices*, verse (1851), and *The Three Germanys: Glimpses into their History* (1889).

Fayal, fī-äl′, an island of the Azores, west of Pico; area, 68 square miles. It is quite mountainous and has a fertile soil and a good climate. Pop. 30,000.

Fayerweather, fâr′WETH-er, DANIEL B. (1821–90), American merchant and philanthropist, was born in Stepney, Conn. He acquired a large fortune in the leather business in New York City. His bequests, direct and indirect, of $5,000,000 to various charitable and educational institutions, were, after a fifteen years' contest in the courts, fully sustained.

Fayette, fā-et′, town, Iowa, in Fayette County, on the Chicago, Milwaukee and St. Paul Railroad; 9 miles south of West Union. It is the seat of Upper Iowa University. Dairying and farming are the chief industries. Pop. (1910) 1,112; (1920) 1,122.

Fayette, city, Missouri, county seat of Howard County, on the Missouri, Kansas and Texas Railroad; 14 miles northeast of Boonville. It is situated in a stock-raising and agricultural region containing deposits of coal, limestone quarries and sulphur springs. Bricks and tile are the chief articles of manufacture. It is the seat of Central College for men and women, under the control of the Methodist Episcopal Church, South. Pop. (1910) 2,586; (1920) 2,381.

Fayetteville, city, Arkansas, county seat of Washington County, on the St. Louis and San Francisco Railroad; 50 miles northeast of Fort Smith. It is the seat of the University of Arkansas and a Commercial College, has a U. S. Experiment Station, an opera house, and a Masonic temple. It is a summer resort and a shipping point for fruit. Coal, lead and zinc occur in the vicinity. The chief manufactures are hardwood wagon stock and white lime. It was the scene of several small engagements in the Civil War and the battles of Prairie Grove and Elkhorn (Pea Ridge). Pop. (1910) 4,471; (1920) 5,362.

Fayetteville, city, North Carolina, county seat of Cumberland County, on the Cape Fear River, at the head of navigation, and on the Atlantic Coast Line, the Aberdeen and Rockfish, the Carolina, and the Norfolk Southern Railroads; 55 miles southwest of Raleigh. The leading manufactures are cotton goods, silk cloth, knit underwear, flour and cottonseed oil. It is a wholesale distributing point for commercial fertilizers, and trucking point for northern markets. Among the notable buildings are the City Hall, Pittman Hospital, Highsmith Hospital, and Cumberland Bank building. It is the seat of a State normal college for negroes. It was settled in 1726, incorporated as Campbelltown in 1762. Pop. (1930) 13,049; (1940) 17,413.

Fayetteville, town, Tennessee, county seat of Lincoln County, on the Elk River, and on the Nashville, Chattanooga and St. Louis Railroads; 80 miles southeast of Nashville. It is surrounded by an agricultural district and has manufactures of cotton yarns, flour, lumber, tobacco, carriages, leather, and machinery. It is the seat of Bryson College. Pop. (1910) 3,439; (1920) 3,629.

Fayrer, fâr′er, SIR JOSEPH (1824–1907), English physician, was born in Plymouth. He entered the medical service of the navy and after doing service as medical officer in the Burmese War (1852) and the Indian Mutiny (1857), he was appointed professor of surgery in the Calcutta Medical College. Elected president of the Medical Board (India Office, 1874–95), he was physician-extraordinary to the King (1901–07). He accompanied the royal princes on their Indian tours (1870 and 1875), and is the author of works on diseases caused by the climate of India. Consult his *Recollections of my Life*.

Fayûm, fa-yōōm′, province, Egypt, formed by a natural depression in the hills on the west side of the Nile; area, 493 square miles. It is an oasis of the Libyan Desert. In ancient times it was the seat of worship of the crocodile-headed god Sobk. The principal products are corn, cotton, cattle, and sugar-cane; it is also noted for its roses, figs, apricots, grapes and olives. The district is renowned for the important papyri there discovered. The chief town is Medinet-el-Fayum. Pop. (1927) 552,581.

Fazokl, fä-zō′k'l, town, Egyptian Sudan, on the left bank of the Blue Nile.

Fazy, fá-zē′, JEAN JAMES (1796–1878), Swiss publicist, was born in Geneva. He founded the Radical newspaper *Revue de Genève*, and was responsible for the constitution drawn up by the provisional Radical government of 1846, of which he was the leader. Through lavish extravagance in the adornment of Geneva and otherwise, the government fell fifteen years later; Fazy failed to secure reelection, and retired into private life. His principal books are *Précis de l'histoire de Genève* (2 vols., 1838-40), and *Cours de législation constitutionelle* (1874).

Fealty, a feudal custom which binds a tenant to his feudal lord. It is still an incident of tenure in England, but is no longer exacted.

Fear, a primary emotion characterized by a specific pain or misery, some disturbance amounting at times to paralysis of the active energies, and a temporary establishment of a fixed idea of impending evil. According to some authorities, fear presupposes the necessity for practical readjustment to environment, and arises when, through the temporary disorganization due to some suddenly emerging circumstance or danger, adjustment is impossible. Bain describes the emotion as originat-

ing in the apprehension of coming evil. Spencer describes fear as being essentially the revival on a given stimulus, of past experiences of pain. There is no fundamental inconsistency in these views. Fear may vary from instinctive surprise or wonder to terror. In the mildest form, there is some interference with the organic functions; in the extreme form, there is a total functional derangement. Intellectually, the mind becomes concentrated on some single idea, which subdues everything to itself. The extreme attention so induced is evidenced by the subsequent precise memory of detail experienced.

Generally, fear in the individual is the product of danger, and instinctive fear is the product of race-experiences of danger. The 'apprehension of coming evil' becomes instinctive by selection. Any interference with the organic sensations, as sometimes in acute melancholia, may result in extreme and prolonged emotions of fear. The physical and mental disturbances due to extreme pain are in most respects identical with those due to fear, the possible recurrence of pain being a stimulus to fear. The physical expressions of fear are among the most familiar of experiences. In detail, fear involves a disturbance of both the muscular and the visceral systems. The physical signs of a typical case are mainly these: open mouth due to relaxation of jaw muscles, raised eyebrows, arrest of muscular activity, sometimes crouching 'as if instinctively to escape observation' (Darwin), hurried respiration, enfeebled expiration, palpitation of the heart, pallor of skin, perspiration (cold sweat, due to vaso-motor and secretory nerve disturbances), erection of skin hairs (goose-skin), tremor of superficial muscles, arrest of salivary secretion, disturbance of other glandular secretions (*e.g.* breasts), trembling of limbs, or lips, huskiness, indistinctness or total failure of voice, dilatation of nostrils. In extreme terror there may be staring and protrusion of eyeballs, extreme dilatation of the pupils, convulsions, the specific scream or screech or howl of terror, followed by relaxation of muscles and total collapse. For critical discussion of theories see Stout's *Manual of Psychology;* for physical signs, Darwin's *Expression of the Emotions in Man and Animals* (2d ed. 1890); for concrete presentment of massive effects of fear, Stephen Crane's *Red Badge of Courage.*

Fear, Cape, a promontory off the southern coast of North Carolina, extending into the Atlantic Ocean. Its surrounding waters are usually turbulent and its vicinity is dreaded by navigators.

Feast, a term applied to days or seasons set aside for the celebration of some joyous event. Such celebrations were widespread and originally were generally of a religious character. Thus Egypt had her feasts of the Dead, and others in honor of Ammon, Osiris, Isis, and Horus. Greek festivals, few at first, many by the time of Pericles, included the Olympic (quadrennial and most important), Nemean, Pythian, and Isthmian games. Roman banquets, mere bribes for office in decadent days, were notoriously magnificent; festivals proper, few and twofold —*viz.* civil and religious. The former included the Quirinalia, in honor of Romulus, Saturnalia, and others; the latter, Lupercalia (in honor of Pan), Minervalia, and Cerealia. Jewish feasts embraced the Sabbath, their only weekly celebration; the Day of Atonement; the Feast of Trumpets or New Year; of Tabernacles, in memory of the journey through the wilderness; of Pentecost, at the close of harvest; of Unleavened Bread (the Passover) in commemoration of the saving of their firstborn; of Jubilee, observed after seven times seven years; and such post-exilic festivals as those of Esther or Purim, of the Dedication of the Temple, of its restoration by Judas Maccabæus, of the Wood Offering for Temple use.

Christian love feasts or *agapæ,* symbols of social equality, at which the Eucharist was celebrated, were founded on Greek and Roman precedents, were common in the early church, but were discontinued, owing to misuse, after the 4th century. Sunday joyfully commemorated the resurrection; and Easter, the Paschal Feast, formed a basis for a yearly cycle of festivals, of which Christmas and the Epiphany (Dec. 25 and Jan. 6, equal birth and baptism of Jesus Christ) are conspicuous and fixed, others, depending on the date of Easter, minor and 'movable.' Anniversary commemorations of martyrs termed 'natalitia,' traditional according to Tertullian, were early celebrated, generally at the place of burial. Thus, after 117 A.D., the church of Antioch honored Ignatius, and that of Smyrna, Polycarp.

The tendency of the Reformation was to sweep away the greater number of feast days or days of holy obligation and Sunday alone was retained by all the churches. The Church of England and the Protestant Episcopal Church of America retained Christmas, Easter, Ascension, Whitsunday, Trinity, the Circumcision, Epiphany, the Purification, All Saints, the Annunciation, the feasts of the various apostles and evangelists and a few others. In the Roman Catholic Church the tendency has been to add new saints' days and other feasts, but to diminish the number of holy days of obligation.

Feather Grass (*Stipa pennata*), a genus of hardy, beautiful perennial grass, long cultivated in gardens. It bears narrow, one-flowered spikelets, with long, feathered awns which remain when the fruit is picked before maturity.

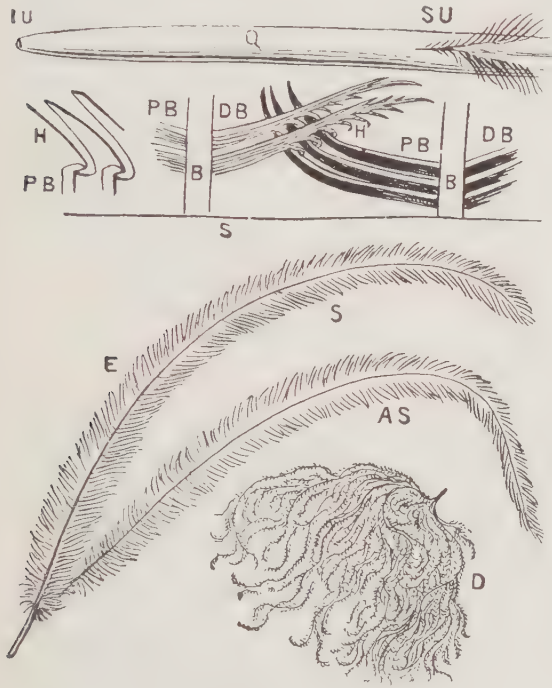
Feather River, river, California, tributary of the Sacramento, rises in the Sierra Nevada range. It flows for a length of about 225 miles through a rich gold producing country and abounds in beautiful scenery. It is navigable as far as Marysville.

Feathers, the characteristic epidermal appendages of birds, occurring nowhere else throughout the animal kingdom. A feather generally consists of a central axis or scape, the upper part of which bears the lateral outgrowths which constitute the vane. The axis is divided into a lower region, the hollow calamus or quill, and an upper, the solid rachis. At the sides of the rachis are placed two rows of barbs, each of which bears two rows of secondary processes or barbules, the barbules of each barb being locked to those of the next by means of hooklets and folds. As a result of this interlocking arrangement the vane of the feather forms a strongly resistant surface, admirably adapted for flight. In birds which do not fly—such as the emu, cassowary, and ostriches, the typical running birds—the barbules are without hooklets and folds, and the disconnected barbs give the plumage its characteristic 'fluffy' appearance.

In very many birds, again, certain of the feathers which clothe the body have elongated barbules without hooklets and folds, forming what are known as down feathers. In not a few cases, also, where the males and females differ strikingly in appearance, certain of the feathers in the male are strangely modified for purposes of ornament, as witness the 'wires' of some birds of paradise, the crests and gorgets of hummingbirds, and so on.

Feathers have been derived from the scales of reptiles; they differ markedly from the homologous hairs of mammals in that they are distributed over the body in definite feather tracts, and are not scattered uniformly.

The chief uses to which feathers are put are for pens, cushions or beds, and for adornment. Their use in the making of pens was formerly much more extensive than at the present time, when the steel pen has so largely taken the place of the quill. Feathers are largely used for beds and cushions, those of geese and ducks being preferred to those of other fowl; and feathers have always figured more or less extensively as ornamental adjuncts to costume, especially on headgear. For this latter purpose the most popular feathers are those of the ostrich, emu, peacock, bird of paradise, and pheasant. See BIRDS; OSTRICH.



The Structure of a Feather

Q, Quill; S, shaft; IU, inferior umbilicus; SU, superior umbilicus; B, barb; DB, distal barbule; PB, proximal barbule; H, hooklets; D, down feather of swan; E, feather from back of emu.

Feather Star, any of the living crinoids, especially the rosy *Comatula rosacea*, familiar on the Atlantic coast of Europe. See COMATULA, and CRINOIDEA.

Febiger, fē'big-*er*, JOHN CARSON (1821–98), American naval officer, was born in Pittsburgh, Pa. He became a midshipman in the U. S. Navy in 1838, was engaged in the coast survey (1852–7), and in the Civil War as commander (commissioned in August, 1862), commanded the steamer *Kanawha* in the West Gulf Blockading Squadron (1862–3), the steamers *Neosho*, *Lafayette*, and *Osage* in the Mississippi Squadron (1863), and the steamer *Mattabeset* in the North Atlantic Blockading Squadron (1864–5). In May, 1868, he became a captain, and in August, 1874, a commodore. He commanded the Washington Navy Yard (1876–80); and in 1882 he became a rear admiral and was retired from active service.

Febrifuge, feb'ri-fūj, in medicine, a therapeutic agent employed to overcome febrile symptoms. The application of ice, treatment by baths, and the administration of purgatives, sudorifics, and antipyretics may all be considered febrifugal. As a high temperature is only one indication of the febrile state, the term febrifuge has a wider significance than antipyretic.

February, the second month of the calendar year. It ordinarily contains 28 days, but in leap year it consists of 29. Its ancient name *Februarius* was derived from februare, to purify, or from *Februa*, the Roman festival of general expiation.

Fécamp, fā-käṅ', town and seaport, France, in the department of Seine-Inférieure, on the English Channel, 27 miles northeast of Havre. The church of the Benedictine abbey, founded in the 11th century, was restored in 1895. Over a million and a half bottles of the liqueur 'Benedictine,' formerly a product of the abbey, are made in the town each year. and cotton spinning and weaving, brewing, sugar refining, hardware manufacture and flour-milling are also carried on. The harbor, recently much improved, is a centre for vessels engaged in deep-sea fishing. Pop. (1921) 16,602.

Fechner, *fech'ner*, GUSTAV THEODOR (1801–87), one of the leading philosophical thinkers of Germany, was born in Gross-Särchen, near Muskau, in Lower Lusatia, but after 1817 lived mostly in Leipzig, where from 1834 to 1839 he was professor of physics. The two works in which his general metaphysical views are set forth, entitled *Nanna* and *Zend-Avesta*, appeared in 1848 and 1851, respectively. In these works he argued that the parallelism of soul and body which obtains in the animal world is not confined to it, but extends both below and above it. His system affords, in his own view, a reconciliation of modern science with religion. Fechner is best known, however, as the founder of psychophysics. In his *Elemente der Psychophysik* (1860; 2d ed. 1889) he discussed the methods of measuring psychical in terms of physical processes—in particular, of measuring our powers of sensation and sense-discrimination in relation to external stimuli—and laid down his famous psychophysical law of the relation of sensation and stimulus, that when the latter increases in geometrical, the former increases in arithmetical proportion. In his *Vorschule der Aesthetik* (1876; 2d ed. 1898) he summed up the results of his investigations in another department of psychological study—*viz.* the application of exact and experimental methods to the problems of æsthetic feeling and judgment. He also won a reputation as a writer of humorous essays and poems, under the name of Dr. Mises.

Fechter, *fech'ter*, CHARLES ALBERT (1824–79), Anglo-French actor, was probably born in Paris. He early joined a company of strolling players but in 1844 made his début at the Théâtre Français. Going to London early in the 'sixties, he first essayed the name-part in *Ruy Blas* with brilliant success; the dual rôle in *The Corsican Brothers* and *Hamlet* crowned his triumphs, though his impersonation of the latter was variously criticised. Following these came

Othello, the lead in *The Duke's Motto, No Thoroughfare,* and *The Golden Daggers.* Subsequently he was manager of the Lyceum (1863–8). He visited the United States twice (1869, 1872) before finally settling there. He made his first appearance in New York at Niblo's Garden (Jan. 10, 1870) as *Ruy Blas,* and was later enthusiastically received in other American cities, especially Boston. He retired in 1876. Consult Field's *Life.*

Feck'enham, village, Worcestershire, England; 7 miles southeast of Droitwich. It manufactures needles, pins, and fishhooks. Pop. (1931) 3,744.

Federal Alcohol Administration, a division of the Treasury Department which was created to administer the Federal Alcohol Administration Act of August 1935; to regulate the distilled spirits industry, the wine industry, and the malt beverage industry; to enforce the 21st Amendment; and to exercise jurisdiction over the licensing of liquor interests and the labeling of alcoholic beverages entering interstate markets. In 1936–37 the Administration granted 2,979 permits to distillers and dealers. See PROHIBITION.

Federal Board for Vocational Education, an administrative agency created by act of Congress approved February 23, 1917 (Smith-Hughes Act). This act authorized continuing appropriations to be expended in the states under state plans for the development of vocational education; the work was expanded and increased through the George-Reed Act, the George-Ellzey Act, and the George-Deen Act. It also administered the Civilian Vocational Rehabilitation Act of 1920. By executive order of 1933 the Board's functions were transferred to the Office of Education, which was placed in the Federal Security Agency in 1939. See VOCATIONAL EDUCATION.

Federal Bureau of Investigation, an agency of the Department of Justice which was given general charge of the investigation of all violations of Federal laws (with the exception of those matters specifically assigned by legislative enactment or otherwise to some other Federal investigative body), such as counterfeiting, postal violations, customs violations, immigration and naturalization, and internal revenue matters. Organized in 1908, the activities of the FBI were constantly expanded to meet new conditions of interstate crime, particularly when local police encountered jurisdictional difficulties. J. Edgar Hoover was appointed director of the Bureau in 1924. In 1939 more than 5,000 convictions were secured in cases investigated by the FBI.

Among those matters under the primary jurisdiction of the Bureau of Investigation are: administrative investigations, admiralty law violations; anti-trust laws; applications for positions; violation of the Federal banking laws; bankruptcy frauds; bribery; claims against the United States; claims by the United States; condemnation proceedings; conspiracies; contempt of court; copyright violations; crimes on the high seas; crimes in Alaska; crimes in connection with Federal penal and correctional institutions; crimes on Indian reservations; crimes on government reservations; destruction of government property; espionage; extortion cases; violations of the Federal kidnapping, auto-theft, white-slavery, and racketeering acts; intimidation of witnesses; frauds against the government; neutrality violations; international claims; obstruction of justice; personnel investigations; robbery of all banks subject to Federal Reserve regulations and Federal Deposit Insurance Corporation supervision; sabotage; patent violations; and treason.

Special agents of the Bureau, before appointment, must be between the ages of 23 and 35, graduates of law school and members of the bar with two years of business or legal experience, or graduates of accredited accounting schools with three years of experience. Applicants must be citizens of unimpeachable character and must be in excellent physical condition. Written and oral examinations must be successfully passed, and the highest eligible persons are appointed in the event of vacancies. Other skilled positions in the Bureau require special qualifications. Newly appointed special agents attend service training courses for 16 weeks where they become accustomed to the requirements of their positions and acquire necessary skills. Later periods of training in advanced methods of criminal investigation are provided for the experienced agents.

The FBI, in addition to its field investigative offices, maintains an Identification Division in Washington, D. C., which serves as a clearing house of information pertaining to criminals. There was a total of over 13,200,000 fingerprint records and 14,000,000 index cards in the Bureau's archives in 1940. Service without cost is given to all local police authorities who desire it. A Civil Identification Section is maintained for any citizens who desire to ensure their identity in case of mishap.

The technical laboratories of the Bureau of Investigation contain the most scientific and modern equipment used in crime detection. There are materials and instruments for blood and toxicological examinations, chemical development of latent fingerprints, firearms identification, examination of documents, microscopy, and special photography.

Beginning in 1935, the FBI offered free training courses at its National Police Academy, primarily for the purpose of training future police instructors. The course allowed carefully selected representatives of local, county, and state agencies to be sent to the Academy for instruction in the various phases of law enforcement, with special emphasis placed on methods of teaching and organization of police schools. More than 75% of the graduates, upon completing their course of training, either were promoted in position or became engaged in the training of the staffs of their law enforcement agencies. The school program lasts three months.

In the past fifteen years about 52 millions of dollars were appropriated for the operation of the FBI, while the total savings, fines, and recoveries resulting from FBI work netted about 252 millions of dollars. More than 2,600 police departments throughout the United States make monthly and annual reports to the Bureau concerning offenses known and offenses cleared by arrest, and the number of persons held for prosecution. The total number of participating law enforcement agencies is about 4,300, and the information forwarded, together with the data compiled from the fingerprint cards received by the Bureau, makes possible the collection of comparable crime statistics on a nationwide scale.

The development of the FBI reveals a significant phase in the detection and prevention of crime in the United States.

Federal Children's Bureau. See CHILDREN'S BUREAU.

Federal Commission of Fine Arts. See COMMISSION OF FINE ARTS.

Federal Communications Commission, an independent administrative agency of 7 members, appointed by the president, created by act of Congress approved June 19, 1934, the purpose of which was to provide for the regulation of interstate and foreign communication by wire or radio, centralizing these duties and responsibilities with a view to more effective communications service. The Act applied to all interstate and foreign communi-

ANALYZING STAINS IN THE TECHNICAL LABORATORY OF THE FEDERAL BUREAU OF INVESTIGATION

EXAMINING A SUSPECT BULLET AND A TEST BULLET THROUGH THE COMPARISON MICROSCOPE

Official photos, Federal Bureau of Investigation

TRACER BULLETS FIRED FROM MACHINE GUNS BY SPECIAL AGENTS OF THE FEDERAL BUREAU OF INVESTIGATION DURING FIREARMS TRAINING

cation by wire or radio; to all interstate and foreign transmission of energy by radio (broadcasting); to all persons engaged within the United States in such activities; and to the licensing and regulation of radio stations. Penalties were provided for violations of the Act or of the rules and regulations of the Commission.

Federal Council of the Churches of Christ in America, THE, was organized by the Interchurch Conference on Federation in New York City in 1905, and held its first regular meeting in Philadelphia in 1908. Its chief purpose is the correlation and unification of the 28 Christian denominations which form the constituency of the Council; but it claims no authority over those churches, nor does it formulate creeds and forms of worship. The work is carried on by representative executive and subordinate committees, and by commissions, which are engaged in promoting international peace and arbitration, home and foreign missions, temperance, family life, Sunday observance, evangelism, week day religious instruction, and the social welfare of the people. The Council also co-operates with state, county, and local federations. Special commissions have reported upon the country church, the industrial conditions of several cities, the church and modern industry, prohibition, and international peace.

The following general national denominations constitute the membership of the Council: Baptist, Christian, Congregational, Disciples of Christ, Friends, German Evangelical, Evangelical, Lutheran, Methodist, Moravian, Presbyterian, Protestant Episcopal, Reformed, United Brethren, and United Evangelical. Meetings are held quadrennially. National headquarters are in New York City. Consult *Reports; Handbook of the Churches; Church Federation* (1905); *The Church of the Federal Council* (1915); *Social Work of the Churches* F. E. Johnson, ed. (1930).

Federal Deposit Insurance Corporation, a government instrumentality organized under authority of the Banking Act of 1933, amended in 1934, 1935, 1938, and 1939, the chief purpose of which was to insure the deposits of all banks which were entitled to the benefits of insurance under the law. The Banking Act gave the Corporation power to pay off the depositors of banks closed without adequate provision to pay their depositors; to act as receiver for all suspended national banks and for suspended state banks when appointed by state authorities; to prevent the continuance and development of unsafe and unsound banking practices; and to facilitate mergers when such actions prevent loss to the Corporation. Management of the Corporation was vested in a Board of Directors of three members, two being appointed by the President for six years and one being the Comptroller of the Currency. The maximum amount of an insured deposit was set at $5,000. Of 15,257 operating banks in the United States, deposits in 13,709 were insured; of these, 6,338 were automatically insured by virtue of their belonging to the Federal Reserve System, while 7,323 joined voluntarily; deposits amounting to $23,000,000,000 were protected by the FDIC. In 1938 FDIC acted to protect the funds of 201,437 depositors in 74 insolvent banks, either by paying them off or by making loans to facilitate the absorption of banks by sound insured institutions. Of 60,000,000 depositors in insured banks, more than 98% were fully protected. Capital stock of $289,299,556.99 was subscribed by the Treasury and the Federal Reserve Banks.

Federal District, a district set apart for the federal government of various states. The Federal District of Brazil includes the city of Rio de Janeiro (q.v.), and comprises an area of 538 square miles, and a population of 1,468,621 (1929). The Federal District of Mexico has an area of 578 square miles, and (1930) 1,217,663 population (see MEXICO, FEDERAL DISTRICT OF). The Federal District of Venezuela contains an area of 45 square miles. The District of Columbia of the United States and the Yass-Camberra District in New South Wales are also Federal Districts.

Federal Emergency Relief Administration, a federal relief agency established by act of 1933, extended by act of 1936. In 1938 it was merged into the WPA (q.v.).

Federal Farm Mortgage Corporation, a federal governmental corporation established by act of Congress approved Jan. 1934, for the purpose of aiding in financing the lending operations of the Federal Land Banks and the Land Bank Commissioner, particularly in re-financing farm debts. It was capitalized at $200,000,000 and allowed to issue up to $2,000,000,000 in bonds. It was placed under the Department of Agriculture.

Federal Government. See FEDERATION.

Federal Housing Administration, an agency created by the National Housing Act of 1934, amended each year to 1939, with the object of insuring lending institutions against losses incurred on two types of loans: those for the repair, alteration, or improvement of property and those secured by mortgages on structures designed for residential purposes. Total business transacted by the Administration from 1934 to June 1939 amounted to nearly four billion dollars. This included applications for home mortgage insurance totaling $3,011,000,000; modernization and repair loans amounting to $840,000,000; and commitments to insure mortgages on rental housing projects amounting to $125,000,000. The maximum liability in insurance outstanding at a particular time was set at $100,000,000. The purpose of the program was the encouragement of improvements in housing standards and conditions, through a general reduction in mortgage interest rates and financing costs; the establishment of uniform mortgage lending and appraisal rates; and popularization of the long-term, amortized, high loan-value mortgage. The Administrator was authorized to insure first mortgage loans made by approved lending institutions on both new construction and existing properties. Thus it became possible to purchase a $10,000 house with a down payment of $1,400.

Federalist, THE, was the name of a series of essays which appeared in *The Independent Journal*, New York, between Oct. 27, 1787, and April 2, 1788. They were afterward printed in book form under the title of *The Federalist*, and are eighty-five in number—the last eight being added in the collected edition. They were written under the pseudonym 'Publius,' and although the authorship of some of the essays has caused much discussion, it is certain that they were inspired by Alexander Hamilton (q.v.), and were the production mainly of Hamilton himself, of James Madison, and of John Jay. They were written in support of the adoption of the proposed Federal Constitution, and against the party of anti-Federalists who wished to limit the action of the central government. They had a wide circulation, especially in New York State, to which they were particularly addressed, and were the chief instrument in converting the States to the Federal idea. They have subsequently been regarded as a brilliant and searching exposition of the Constitution, and have even been recognized by the law courts as the most important interpretation of the American Constitution. The most useful edition is that edited by Paul L. Ford, containing a full index.

Federalists, in American po-

litical history, a name first applied to those who advocated the adoption of the Federal Constitution of 1787—in this they were opposed by the Anti-Federalists (q.v.); and later applied to those who, after the development of national parties in President Washington's first administration, followed the leadership of Alexander Hamilton (q.v.) rather than of Thomas Jefferson (q.v.), the leader of the Democratic-Republicans. The Federalists stood for centralization, for the nationalization of the Federal Government, and for a broad construction of the Federal Constitution. President Washington himself, although he attempted to stand aloof from parties, was essentially a Federalist.

The actual organization of the National Government was the work of the Federalists, who thus rendered a service of inestimable value. But the opposition, under the skillful leadership of Jefferson, gradually gained strength; the Federalist leaders themselves failed to build up a large popular following—Hamilton had little faith in the mass of the people; and John Adams, the Federalist candidate, was elected President only by a narrow margin in 1796. During President Adams' administration the Federalist party was greatly weakened by internal dissension; and by the passage of the Alien and Sedition Laws (q.v.) and other acts became unpopular throughout the country. Consequently, Jefferson was elected President in 1800, and with the close of Adams' administration (March, 1801) the period of Federalist ascendency ended. The Federalists then became the party of the opposition, and in the ensuing years exchanged principles, to a large extent, with the Democratic-Republicans. The Federalists opposed the restrictive system and the War of 1812, and owing to the Hartford Convention became utterly discredited. Finally, in the Presidential election of 1820, not a single Federalist electoral vote was cast, and the Federalist Party disappeared from national politics. Federalist principles, however, later reappeared in the platforms of the National Republican, Whig, and Republican Parties. Chief Justice Marshall (q.v.), a Federalist, perpetuated those principles in the interpretation of the Constitution. See Hartford Convention; United States, *History*.

Federal Land Banks. See Rural Credits.

Federal Power Commission, a governmental authority created by act of 1920 and composed originally of the Secretaries of War, Interior, and Agriculture. It was reorganized in 1930 to include five full-time commissioners appointed by the President, and in 1935 its duties were enlarged to include jurisdiction not only over water power projects on navigable streams or affecting the interests of interstate or foreign commerce, or upon public lands, as previously provided, but also over the interstate movement of electrical energy. Its policy was to provide for the development and improvement of navigation, and the development, transmission, and utilization of power on streams subject to Federal jurisdiction, upon lands of the United States, and at Government dams, by private and public agencies acting under licenses issued by the Commission. The Federal Power Act of 1935 embodied an extensive scheme for the regulation of electricity utilities engaged in interstate commerce. Its task was to extend Federal regulation to matters which could not be regulated by the states and also to strengthen and assist states in their regulatory powers by the use of Federal authority. The FPC was empowered to guard against monopoly and to investigate unfair practices in the water power, electricity, and natural gas industries. It was given supervisory functions over the Tennessee Valley Authority, Bonneville Dam, and Fort Peck Dam.

Federal Reserve Act. See Banking in the United States.

Federal Reserve Board, for the supervision of the Federal Reserve System of the United States, was created by Act of Dec. 23, 1913, and was formally organized on Aug. 12, 1914. It is composed of seven members appointed by the president with the consent of the senate, for a term of 14 years with the exception of the chairman who is appointed for 4 years. A fair representation of the financial, agricultural, commercial, and industrial interests is required in the selection of the board members.

By the terms of the Federal Reserve Act the Board exercises general supervision over all Federal Reserve Banks, and is empowered to examine the accounts, books, and affairs of reserve banks and member banks; to supervise and regulate the issue and retirement of Federal Reserve notes; in cases of emergency to suspend the reserve requirements of the Act for periods not exceeding thirty days, and to renew such suspension for not more than fifteen days; to permit or require Federal Reserve Banks to rediscount the paper of other reserve banks at rates fixed by the Board; to suspend and remove officials and directors of Federal Reserve Banks; to designate Reserve cities; and to suspend the operation of Federal Reserve Banks violating the Act.

Each of the board members is also a member of the Federal Open Market Committee, whose membership includes, in addition, five representatives of the Federal Reserve Banks, each such representative being elected annually by the boards of directors of the specified banks. Open-market operations of the Federal Reserve Banks are conducted under regulations adopted by the Committee with a view to accommodating commerce and business, and with regard to their bearing upon the general credit situation of the country; and no Federal Reserve Bank may engage or decline to engage in open-market operations except in accordance with the directions and regulations of the Committee. These open-market operations consist of the purchase and sale in the open market of obligations of the United States, certain other securities, and bills of credit and bankers' acceptances of the kinds and maturities eligible for discount by the Federal Reserve Banks. See Banking in the United States.

The *Federal Reserve Bulletin* is the official publication of the Federal Reserve System. In 1935 the name of the Federal Reserve Board was changed to the Board of Governors of the Federal Reserve System. To meet its expenses and pay salaries of members and employees, the Board makes semi-annual assessments upon the Federal Reserve Banks in proportion to their capital stock and surplus.

Federal Savings and Loan Insurance Corporation, a governmental agency created under authority of the National Housing Act of 1934 and placed under the supervision of the Federal Loan agency in 1939. The Corporation was created to insure the savings of home-financing and thrift institutions, by guaranteeing the safety of withdrawable investments and credited earnings up to $5,000 for each investor. Insurance was granted to all Federal savings and loan associations, and to those state-chartered building and loan, savings and loan, and homestead associations, and co-operative banks which applied and were approved. Standards of eligibility were made to include sound financial condition, competent management, safe lending policies, ability to meet withdrawal demands, and satisfactory earning power. In June, 1939, there were 2170 insured institutions with total assets of $2,339,000,000. All insured members of the system were supervised and

audited by the Corporation, and if any defaulted a custodian was appointed to the institution. The capital of the Corporation was $100,000,000, obtained by the sale of its stock to Home Owners' Loan Corporation. Administration of the Corporation was vested in a board of trustees composed of the five members of the Federal Home Loan Bank Board, with executive offices in Washington.

Federal Surplus Commodities Corporation, a non-stock, non-profit corporation created under the laws of Delaware, at first named the Federal Surplus Relief Corporation, but changed to the above title in November 1935. It was made responsible to the Secretary of Agriculture. The chief function of the organization was to remove price-depressing farm surpluses by furnishing the machinery for their purchase for purposes of export and relief distribution by state welfare agencies. Domestic consumption was increased by the distribution of surplus farm products to low-income families through purchase and donation of the commodities.

Federal Trade Commission, U. S., a non-partisan commission created by Act of Congress, approved Sept. 26, 1914. It is composed of five members, who are appointed by the President of the United States for seven years each, and who are prohibited from engaging in any other business, vocation, or employment during their term of office.

The Commission is empowered and directed to 'prevent persons, partnerships, or corporations, excepting banks and common carriers subject to the acts to regulate commerce, from using unfair methods of competition in commerce.' To this end, whenever it has reason to believe that unfair methods are being employed, and that a proceeding by it in respect thereof would be to the interest of the public, it shall serve a complaint upon the offender, and conduct a hearing in the matter in not less than thirty days after the filing of the complaint. If the methods in question shall be found illegal, the Commission shall direct the defendant to desist from their employment, and may apply for the enforcement of its order to the circuit court of appeals, which has exclusive power to review, set aside, or modify such orders. It is also empowered to enforce compliance with those sections of the Clayton Anti-Trust Law relating to price discrimination, tying contracts, the acquisition of stock of competing corporations, and interlocking directorates, except when applicable to common carriers, banks, and trust companies.

The Commission is further empowered to conduct investigations relating to business practices and management, and to require annual and special reports from such corporations as come within its jurisdiction; to investigate the enforcement of decrees brought against corporations under the Anti-Trust Law; to interpret the requirements of the law, and to investigate and make recommendations for the readjustment of corporations thereto; and to investigate and report to Congress on trade combinations 'in and with foreign countries where associations, combinations, or practices of manufacturers, merchants, or traders or other conditions may affect the foreign trade of the United States.'

Refusal to testify before the Commission or to respond to its subpœna, falsification of evidence, failure to submit required reports, and giving unauthorized publicity to information in the possession of the Commission are punishable by imprisonment for not more than six months, a fine not to exceed $1,000, or both.

The work of the Commission is conducted through an administrative branch, under the Commission's secretary; an economic department having charge of economic investigations and corporation reports; a legal department attending to investigations, hearings and court work; and a joint board of review which passes upon cases, after the economic and legal departments have submitted reports. Headquarters are at Washington, D. C., but hearings may be held in any city. The FTC, under the Wheeler-Lea Act of 1938, is charged with preventing the dissemination of any false advertisements of food, drugs, devices, or cosmetics.

Federated Malay States. See MALAY STATES, FEDERATED.

Federa'tion and *Federal States.* Federation is the more or less permanent union of two or more states which, while retaining their autonomy, transfer the management of certain matters of common concern, particularly defence and foreign affairs, to a government representing all the federal states. Various attempts at federation were made among the petty states of ancient Greece, from the early days of the Amphictyonic League — a loose organization, mainly for religious purposes—down to the Achæan and Ætolian Leagues, which united large parts of the country at the date of the Roman conquest in the second century B.C. The latter was a confederacy of tribes formed about 320 B.C., and dissolved in 189 B.C. by the treaty with Rome. The Achæan League was a confederacy of cities founded in 277 B.C. Its fundamental laws were that the confederacy should form one inseparable state, that each town which joined it should have equal rights with the others, and that all members in their relations with foreign nations should be regarded as dependent on and bound to obey the federal government. It included the principal towns of the Peloponnesus, and was thoroughly democratic. The league was destroyed in 146 B.C., when Greece became a Roman province. The different forms of political federation may be considered under four general types:

1. The lowest type of federation occurs where the bond of union is the personal link created by the accidental circumstance that the ruler or monarch of two or more communities is one and the same person. Of this type was the connection which existed for three centuries between England and Aquitaine or Gascony, and, after the accession of James I. in 1603, between England and Scotland. A more conspicuous example can be seen in the great Hapsburg empire, so called, which flourished under Charles V., and in which Spain, Naples, Sicily, Austria, and the Netherlands were, at least for some purposes, a single political body. A similar result in later times was brought about by the accession of William of Orange to the thrones of England and Scotland, while he still continued to be stadtholder of the United Provinces; and, later still, by the union of Great Britain and Hanover in the house of Brunswick. The recently dissolved union of Sweden and Norway was also of this order.

2. Ascending a little higher in the scale, we come to that type of union which is created when the fortunes of one country become linked to those of another by the imposition or acceptance of a common authority, regardless of dynastic changes. Of this kind was, *de jure*, the connection between Ireland and England after the establishment of Anglo-Norman rule at Dublin; of England and Wales from the conquest of the latter by Edward I. to its final incorporation by Henry VIII.; of Scotland and England after the union in 1707. Such is also the connection of Russia and Finland, and of Austria and Hungary. In all these cases wide differences of internal administration exist between the countries thus united; but other states can take no notice of such differences.

3. We now come to a third and much more complex type of union, to which the name *confederation* in a restricted sense is sometimes applied. This occurs where a number of independent communities voluntarily unite together for certain specified purposes, which involve not merely alliance, but actual co-operation through permanently established organs. As an example of this form of union the United States under the Articles of Confederation may be cited, where each state retained its sovereignty, freedom, and independence, and every power not expressly delegated to the Congress, and where the purpose of union was common defence against foreign foes. This type usually involves the co-operation of a much larger number of communities than the personal or real unions. Though the Swiss League began with only three states, it eventually increased to twenty-two. The Netherlands Provinces, which established the Protestant republic in 1581, were seven in number. The Confederation of the Rhine (1806) boasted thirty-eight members. The North German Confederation of 1866 comprised twenty-two states.

Although the confederation may contain a leading power (*e.g.*, Holland in the Dutch Republic, Prussia in the North German Confederation), it is clear that such power is not alone able to effect the association, else the tedious and difficult process of confederation would rarely be substituted for the more direct and complete method of incorporation. Occasionally, as in the North German Confederation, executive officials are appointed; but more usually the execution of confederate legislation is left to the officials in the various states within their own territories.

4. Federation, in the strictest sense, is a far closer type of union than that of the first Dutch republic, the Confederation of the Rhine, or the Swiss League. Not only has the federal state a complete political organization —legislative, executive, and judicial—but in this organization it recognizes no distinction of states. Doubtless each state is entitled to special representation in the deliberative assembly; but once collected, the members of the assembly act for the whole federation, and not for their own states. Within its own proper sphere the government of the federal authorities is irresponsible and absolute. Much of the internal as well as all the external administration of the affairs of the states is in its hands. The precise extent of this administration varies, of course, from one example to another; but postal and telegraph matters, coinage, railways, are usual objects of federal administration.

On the other hand, even the closest type of federal union is clearly to be distinguished from the 'unitary' or simple state by the fact that the autonomous rights of the different members do not depend upon the permission or authority of the central government. The powers of the State of Massachusetts or of Ohio flow as directly from the Constitution itself as do the powers of the central government at Washington. The unwritten rule, that the imperial Parliament of Great Britain does not interfere in the internal affairs of the great self-governing colonies, is a rule of the soundest policy; but it is not a rule of law.

Finally, it may now be taken as fairly settled that no right of secession exists in a true federal state. None of the conspicuous cases—*e.g.*, the United States, Germany, Canada, the Australian Commonwealth—make any provision for such a step, though provisions for the admission of new states are by no means rare.

Instances of federation at the present day are the Swiss Republic, the German Empire, and the United States of America. Within the British Empire, Canada and Australia are federations, though the powers of the federal government are much greater in the former than in the latter; while South Africa is a true organic union, the provincial councils depending for their powers and existence entirely on the Union Parliament.

It remains to point out the chief advantages and disadvantages of this method of organization. An enormous area and population, such as those of the United States or Germany, cannot be adequately administered in details from a single centre. In spite of telegraphs and railways, a prolific press, and a diligent public service, a minister cannot really feel the pulse of diverse and widely separated communities living under most divergent conditions. He can make a general survey, and interpret fairly well the great currents of feeling and tendency. But he cannot gauge local peculiarities or bear in mind local details. Again, great political organizations make for peace, not only because they reduce the number of possible combatants, but because they involve such enormous interests. Furthermore, the necessary accompaniments of the formation of a union of this type do a vast amount of good. Broadly speaking, a federal union can be brought about only by agreement; and an agreement, on vital topics, is not infrequently the result of free and fearless discussion.

Against the advantages of the federal form of government must be set undoubted disadvantages. The division of authority in matters of legislation and finance often creates confusion. In the United States, the principle that the Federal Government possesses only those powers expressly granted to it by the Constitution renders impossible uniform legislation dealing with labor, corporations, etc.—matters that were clearly local in nature at the time of the formation of the Federal Government, and hence left to the legislative province of the States. Moreover, in times of crisis the complicated organization of a federal state renders it impossible for the whole resources of the body politic to be concentrated swiftly and secretly at a given point.

Still, it is a remarkable fact that, in the contests which have taken place between federal and 'unitary' powers, the former have often been victorious. Marlborough defeated the highly centralized power of Louis XIV., even though he had to work with their high mightinesses of the Dutch federation; Washington beat the British armies with his federal militia; and federal Germany defeated the French empire.

See CONSTITUTION; DEMOCRACY; GOVERNMENT; SOVEREIGNTY.

Consult Burgess' *Political Science and Comparative Constitutional Law;* Hart's *Introduction to the Study of Federal Government;* Bryce's *Holy Roman Empire* (new ed. 1904); Freeman's *History of Federal Government;* Adams and Cunningham's *The Swiss Confederation;* Bryce's *The American Commonwealth* (new ed. 1912); Moore's *The Commonwealth of Australia;* Brand's *The Union of South Africa* (1909).

Federation of Arts, American. See ARTS, AMERICAN FEDERATION OF.

Federation of Labor, American. See LABOR, AMERICAN FEDERATION OF.

Fee. See FEES.

Fee, otherwise called FIEF, FEOD, or FEUD (Latin *feudum*), signified originally an estate in land held of another, but now applied to one which descends to heirs—in other words, an estate of inheritance. It may either be *fee simple* (q.v.) where the property is granted to A and his heirs, or *fee tail* (q.v.), where a special class of heirs is designated, as in the case of a grant to A and the

heirs male of his body (see ESTATES). A fee simple estate may be either *absolute* or *qualified*. The former denotes the largest estate an individual can possess, being free from all restrictions as to who can take as heir, and from all conditions under which the estate may be brought to an end. When the words fee or fee simple are employed alone, an estate of fee simple absolute is meant. A qualified fee simple is an estate which is liable to be defeated in certain events.

In Scotland *fee* is also employed to distinguish the radical right of ownership which one has in any property, real or personal, from other rights over it enjoyed by third parties. See TENURE.

Feeble Minded. See MENTAL DEFECTIVES.

Feeding Stuffs. This term is applied to all kinds of food materials used for farm animals, and includes fodder or forage, grasses and their products, and many commercial by-products. These materials vary greatly in character. They may be green, wet, or dry; the whole plant, as in the case of hay; only a part of it, as with root crops; and the seeds of grains, or by-products from commercial processes, as linseed cake left after the extraction of oil from flaxseed.

For the most part, feeding stuffs are of vegetable origin, although ground meat, bone and dried blood are used to some extent; and by-products from the dairy, as skim milk, buttermilk, and whey, find extensive use, especially for young animals.

Feeding stuffs may be classed in a general way as (1) coarse fodders, also called 'roughage,' such as hay, straw, corn fodder, silage, and similar coarse materials, and (2) concentrated feeds or 'concentrates,' which include such materials as the cereal grains, leguminous seeds, and the commercial by-products.

Feeding stuffs differ much in chemical composition, but are all made up of various proportions of water, protein, or nitrogenous material, fat, nitrogen-free extract (sugar, starches, etc.), crude fibre, and ash. Green fodders contain as high as 80 per cent. or more of water, together with small amounts of nutritive ingredients, nitrogen-free extract being the principal food constituent present. Roots and tubers resemble the green fodders in composition. Hays and similar coarse fodders are richer in nutritive material than the green feeds, since they have been concentrated by evaporation. The percentage of water is low—about 15 per cent. on the average. Nitrogen-free extract and crude fibre are the principal ingredients present. though some sorts of hay—notably that from clover, alfalfa, and other leguminous crops—contain as high as 12 or 15 per cent. of protein. Most of the grains have a low water content, a fairly high protein content, and a high nitrogen-free extract content, together with small amounts of crude fibre. The commercial by-products vary greatly, some of them, like gluten meal and feed, cotton-seed meal, bran, and peanut meal, containing fairly large amounts of protein. Generally speaking, the fat content of feeding stuffs is low, although some materials, like soy beans and peanuts, contain quite large percentages.

FEEDING STUFFS.

	Water.	Ash.	Protein.	Fibre.	Nitrogen-Free Extract.	Fat
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Corn fodder	79.3	1.2	1.8	5.0	12.2	0.5
Redtop	65.3	2.3	2.8	11.0	17.7	0.9
Timothy	61.6	2.1	3.1	11.8	20.2	1.2
Kentucky blue grass	65.1	2.8	4.1	9.1	17.6	1.3
Red clover	70.8	2.1	4.4	8.1	13.5	1.1
Alfalfa	71.8	2.7	4.8	7.4	12.3	1.0
Corn silage	79.1	1.4	1.7	6.0	11.0	0.8
Corn fodder hay	42.2	2.7	4.5	14.3	34.7	1.6
Redtop hay	8.9	5.2	7.9	28.6	47.5	1.9
Timothy hay	13.2	4.4	5.9	29.0	45.9	2.5
Mixed grass hay	15.3	5.5	7.4	27.2	42.1	2.5
Red clover hay	15.3	6.2	12.3	24.8	38.1	3.3
Alfalfa hay	8.4	7.4	14.3	25.0	42.7	2.2
Cowpea hay	10.7	7.5	16.6	20.1	42.2	2.2
Wheat straw	9.6	4.2	3.4	38.1	43.4	1.3
Oat straw	9.2	5.1	4.0	37.0	42.4	2.3
Cottonseed hulls	11.1	2.8	4.2	46.3	33.4	2.2
Potatoes	78.9	1.0	2.1	0.6	17.3	0.1
Sugar beets	86.5	0.9	1.8	0.9	9.7	0.1
Mangel-wurzels	90.9	1.1	1.4	0.9	5.5	0.2
Turnips	90.5	0.8	1.1	1.2	6.2	0.2
Rutabagas	88.6	1.2	1.2	1.3	7.5	0.2
Carrots	88.6	1.0	1.1	1.3	7.6	0.4
Corn (maize) kernel	10.9	1.5	10.5	2.1	69.6	5.4
Barley	10.9	2.4	12.4	2.7	69.8	1.8
Oats	11.0	3.0	11.8	9.5	59.7	5.0
Rye	11.6	1.9	10.6	1.7	72.5	1.7
Wheat	10.5	1.8	11.9	1.8	71.9	2.1
Soy bean (seed)	10.8	4.7	34.0	4.8	28.8	16.9
Pea meal	10.5	2.6	20.2	14.4	51.1	1.2
Gluten meal	8.2	0.9	29.3	3.3	46.5	11.8
Gluten feed	7.8	1.1	24.0	5.3	51.2	10.6
Brewers' grains	8.2	3.6	19.9	11.0	51.7	5.6
Wheat bran	11.9	5.8	15.4	9.0	53.9	4.0
Rye bran	11.6	3.6	14.7	3.5	63.8	2.8
Cottonseed-meal	8.2	7.2	42.3	5.6	23.6	13.1
Linseed-meal	10.1	5.8	33.2	9.5	38.4	3.0
Peanut meal	10.7	4.9	47.6	5.1	23.7	8.0

Various condimental feeds are much advertised, for which tonic or medicinal properties are claimed. They are usually sold in small packages at a fairly high price per pound. Many analyses have been made which show that they are composed of such common materials as bran, oil meal, ginseng, sulphur, charcoal, fenugreek, ginger, etc., and that they have no special medicinal value; while from the standpoint of nutritive value their cost is out of all proportion to their real worth.

A class of feeding stuffs has recently come into use in which molasses from sugar beet factories and from cane sugar factories is a prominent constituent. Various materials, such as palm-nut meal, bran, ground corn-stalks, dried beet chips, and sugar cane bagasse, are used to absorb the molasses. Some of these, like bran and palm-nut meal, also add considerable protein to the mixture, a constituent in which the molasses is deficient. Sometimes dried blood is mixed with the molasses to increase the protein content. Molasses feeds, as a class, have given excellent results, and are apparently relished by all classes of farm animals.

Feeding stuffs, particularly concentrated feeds, have been extensively adulterated, and most of the United States and the principal foreign countries have passed laws with a view to the suppression of such adulteration.

The most expensive nutrient in feeding stuffs is protein (q.v.), and the proportion of this constituent largely determines the value, especially of the more concentrated feeding stuffs. An-

other factor that influences the relative value of different materials is digestibility, or the proportion of the several nutrients which are retained when the material passes through the digestive tract. Digestibility varies widely with different feeding stuffs. In the case of corn meal, for instance, 68 per cent. of the protein, 95 per cent. of the nitrogen-free extract, and 92 per cent. of the fat are, on an average, digested; while in the case of corn stover, 36 per cent. of the protein, 58 per cent, of the nitrogen-free extract, and 70 per cent. of the fat are digested, on an average. The undigested portions have no value in the nutrition of the animal.

The accompanying table indicates the average composition of the more important feeding stuffs.

Consult the *Bulletins* of the U. S. Department of Agriculture, especially *Bulletin 22* and *Bulletin 77*.

Feehan, fē′an, PATRICK A. (1829–1902), American archbishop, was born in Tipperary, Ireland. After graduating from Maynooth College he came to the United States in 1852, where he was ordained in the Roman Catholic Church. He was pastor of the Church of the Immaculate Conception, St. Louis, from 1859 to 1865; bishop of Nashville, Tenn., from 1865 to 1880; and became the first archbishop of Chicago in 1880. He attained wide distinction by his zeal and ability as an organizer both at Nashville and Chicago, and the educational institutions founded by him became the models for other dioceses. He founded a college, a refuge, and two orphan asylums; and distinguished himself for his labor and devotion during three epidemics of the yellow fever. He was the founder of the Catholic Knights of America.

Feel′ing, as limited to emotion, is a legitimate specialization of the term. Feeling is the accepted name for the fundamental fact of consciousness as experiencing pleasure or pain. But feeling cannot be mere feeling; it is discriminated as this or that, and every mental state is associated with some feeling tone. At one end of the scale is simple sensation, with a minimum of discrimination. At the other end of the scale are the higher emotions—the feeling tone of very complex apperceptions; for example, esthetic feeling is the feeling tone arising on the perception of beautiful objects. The word is also used less accurately as synonymous with sensation. See EMOTION; TOUCH.

Fees may be defined as the charges made by lawyers, physicians, schoolmasters, and members of other professions for services rendered. In Roman law, professional men were remunerated by *honoraria*, for which they could not sue in ordinary form; and this rule is maintained with regard to counsel's fees in England and the countries where the distinction still exists between barristers and solicitors. A barrister cannot sue for remuneration, and, on the other hand, cannot be compelled to refund fees already received on any ground whatsoever. In England before 1849 a physician was in a similar position. In the United States, no professional man is prevented from suing for his proper fees.

As to agreements between an attorney and his client regarding fees, see CHAMPERTY.

Fee Simple, an estate of inheritance held by the grantee without limits and unconditionally. It differs from the fee tail (q.v.) in being transmissible by the owner. Fee simple is of feudal origin. In English law it is an estate of inheritance received from the sovereign, and vested in the owner. In the United States it is an estate of inheritance which belongs to the owner, and which may be transmitted to his heirs unconditionally. A fee simple may be *absolute* or *qualified*, but its principal qualities of heritability and alienability cannot be invalidated or destroyed. See CONDITIONAL LIMITATION; ESCHEAT; ESTATES; EXECUTORY DEVISE.

Fee Tail, an estate of inheritance in land which can descend only to the issue of the tenant. An estate limited to a man and the heirs of his body is an estate in *tail general;* if to the heirs of his body by a particular wife, it is an estate in *special tail;* if to a man and his male heirs only, or his female heirs only, it is an estate in *tail male*, or *tail female*.

By the common law, an estate tail was regarded as a fee simple (q.v.), conditional upon the birth of issue; and this condition being once fulfilled, the estate became a fee simple, and the owner could sell it, and so bar the succession of his heirs. To prevent this, in 1285 the statute *De Donis Conditionalibus* was enacted, forbidding alienation by the tenant in tail. Thereafter the original grantor had a right to the estate when the line of lineal heirs of the tenant ran out, and the right of the tenant's heirs could not be cut off by an alienation of the estate on his part. This tying up of real estate in the hands of the great landed families met with popular disfavor, and was checked by means of fictions invented by the courts. In 1833 it was provided in England that a mere conveyance by the tenant in tail should be sufficient to transfer the estate and convert it into a fee simple.

In most of the United States, estates tail have been abolished by statute. In New York and many other States, provision is made that an attempt to create a fee tail has the effect of creating a fee simple; in other States the tenant takes an estate for life with a remainder in fee to the prescribed heirs. Generally, in the States where estates tail remain, they may be barred by deed of the tenant. See ESTATES; REAL PROPERTY.

Feet. See FOOT.

Fehling's Solution, fā′lingz, is a deep blue liquid, containing cupric hydroxide dissolved in a strongly alkaline solution of potassium tartrate. It is used for the detection and estimation of sugars, such as glucose, by which it is reduced, a red precipitate of cuprous oxide being formed. It does not keep well, and is therefore generally prepared as required by mixing standard copper solution with alkaline tartrate solution, which separately keep well.

Fehmarn, fā′märn, or FEMERN, island of Prussia, in the Baltic Sea, between Holstein and the Danish island of Laaland. Agriculture, stock raising, and fishing are the chief industries. Area, 70 square miles. Pop. 10,000. Chief town, Burg; pop. 3,000.

Feia, Lake, fā′yà, in Rio de Janeiro state, Brazil, near the coast, and 10 miles south of Campos. It is connected with the Parahyba River, and by a canal with the Atlantic Ocean. Area, 200 square miles.

Feijoo Montenegro, fā-hō-oi′mōn-tā-nā′grō, BENITO JERONIMO (1676–1764), Spanish man of letters, a writer of the French school, fashionable in Spain with the coming of the Bourbon kings. He was born at Casdemiro in Galicia, and became a Benedictine monk. His *Teatro Critico* (1726–39), a collection of essays on every conceivable subject, is still considered a classic in Spain, though his scepticism and freedom of speech greatly shocked the clergy. A selection appeared in English as *Essays* (4 vols., 1780). His *Cartas Eruditas* (1742–60) are compositions of a similar character, abounding in wit and learning, but with an affectation of omniscience.

Feilding, fēl′ding, town, Oroua county, New Zealand; 85 miles northeast of Wellington. Pop. 3,000.

Feilding, ROBERT (?1651–1712), known as 'Beau Feilding,' during the reign of Charles II. be-

came notorious as a gambler and profligate. He accompanied James II. to Ireland, and sat in the Irish Parliament of 1689 for Gowran. One of his wives was the Duchess of Cleveland; he was convicted of bigamy in 1706.

Feis, fāsh. The Irish *feis* or *fess* was an assembly or convention, such as that which met at Tara in the reign of Aed, son of Ainmire (572–99), to discuss, *inter alia*, the banishment of the *filid* or bards. The modern Feis-ceoil —*i.e.*, assembly of music—is a society, founded in Dublin in 1897, for the encouragement of native music.

Feith, fāt, RHIJNVIS (1753–1824), Dutch poet, was born in Zwolle, and was burgomaster in his native town from 1780 till his death. Though he achieved decided success with his novels *Julia* (1783) and *Ferdinand and Constantia* (1785), his chief triumphs were won in tragedy—*Lady Jane Grey* (1791), *Inez de Castro* (1793), *Thirsa* (1784), and the *Patriots* (1785) being his principal pieces. His poems, which are of a popularly religious type, were also much admired—*Old Age* and *The Grave* (1792) being the two best known. His lyrics appeared as *Oden en Gedichten* (5 vols., 1796–1814); his Complete Works, with *Life*, in 11 vols. (1824).

Fek'listov Island. See SHANTAR ISLANDS.

Felanitx, fā-lä-nēch', or FELANICHE, town, island of Majorca, Spain; 28 miles northeast of Palma. Earthenware is manufactured; and it has trade in wines, fruit, and cattle. Pop. 12,000.

Felch, ALPHEUS (1806–96), American jurist, was born in York county, Me. He was graduated from Bowdoin College (1827), and in 1833 removed to Monroe, Mich., where he practised law. He was elected to the legislature in 1835–7, and was bank commissioner in 1838–9, when he opposed the frauds under the 'wildcat' banking law. In 1842–5 he was judge of the State supreme court; in 1846 he was elected governor, resigning in 1847 to become U. S. Senator (1847–53). He then served as president of the commission that settled the Spanish and Mexican land claims arising from the Treaty of Guadeloupe-Hidalgo. In 1879–83 he was professor of law at the University of Michigan.

Feldkirch, felt'kerch, town, province Vorarlberg, Austria; 20 miles southwest of Bregenz. It is situated between the two narrow rocky gorges through which the Ill River flows into the Rhine valley. The town is of great military importance, as it commands the entrance into the Tyrol from the west. Pop. 5,057.

Feldspar, feld'spär, or FELSPAR (German *Feldspath*, 'field spar'), a general term in mineralogy for the most important rock-forming group of minerals. The feldspars are all anhydrous silicates of alumina, containing either potash, soda, or lime alone, or two of those bases together. They have a hardness between 6 and 7 —that is to say, they can be scratched with a good penknife. Their specific gravity is about 2.6. They are all, as a rule, white or gray in color, but sometimes pink or green from the presence of impurities; and have a good cleavage, yielding smooth surfaces when broken, and a somewhat pearly lustre. The feldspars also decompose when exposed to the weather, and their surfaces lose their smooth, glassy character, and become covered with a soft earthy outer crust.

The two great subdivisions of the feldspar group are the MONOCLINIC FELDSPARS (which include *Orthoclase*, *Adularia*, and *Sanidine*), and the TRICLINIC FELDSPARS (among which are *Albite*, *Andesine*, *Anorthite*, *Labradorite* *Oligoclase*, *Microcline*, and *Bytownite*). These are distinguished not only by their crystallizing in different systems, but also by their cleavages. The feldspars belonging to these two main groups are further subdivided according to their chemical composition, their crystallographic form, and their external characters. The series of triclinic feldspar with varying proportions of soda and lime in their composition are known as the *Plagioclases* (see PLAGIOCLASE).

The feldspars which occur in rocks that contain much free silica (quartz) are generally orthoclase and microcline, but with these are frequently associated the highly silicated feldspars, albite and oligoclase. The chief habitat of the basic plagioclase feldspar are basic igneous rocks.

The weathering of the feldspars is of importance in the production of clays and soils. Decomposition of feldspar by carbonated waters is occurring on a large scale over the whole surface of the earth, wherever crystalline rocks are exposed to the action of rain. The potash and soda which are set free are absorbed by the roots of plants.

Uses.—The principal use of feldspar is in the manufacture of pottery, enamel ware, enamel brick and tile, and electrical ware. Of these, the most important is its use in the body and glaze of the various grades of pottery and vitrified sanitary ware, in which it constitutes from 10 to 35 per cent. Its value in pottery is that it melts at a lower point than the other ingredients, and serves as a flux, binding the clay and quartz particles together. In glazes the percentage of feldspar used is higher than in the body, and runs from 30 to 50 per cent. Other uses of feldspar are in the manufacture of emery and corundum wheels, where it serves as a binder; in the manufacture of opalescent glass; as a poultry grit; as a constituent of roofing material; and for surfacing concrete work. Small quantities of the purest grades of potash feldspar are used in the manufacture of artificial teeth. It is also used in the manufacture of scouring soaps and window wash. As a potash-bearing fertilizer, ground feldspar has been used, but with results of doubtful value. Attempts are being made to extract from feldspar its content of potash.

The production of feldspar in the United States in 1935 had risen from 93,855 long tons in 1915 to 189,550 tons in 1935, the peak production. The important producing States were California, Connecticut, Maine, Maryland, New York, North Carolina, and Pennsylvania.

See KAOLIN; PORCELAIN; POTTERY; and the separate articles on the different forms of feldspar mentioned herein.

Feldspathoids, feld'spath-oidz, rock magmas high in alumina, lime, potash, and soda, and low in silica, which tend to crystallize into minerals less acid than the normal feldspars. The chief species are *Nephelite* ($Na_8Al_8Si_9O_{34}$), *Leucite* ($KAlSi_2O_6$), and *Melilite* ($Ca_{12}Al_4Si_5O_{36}$). Thus, Nephelite corresponds to Albite (q.v.) of the feldspar group, but has 23 per cent. less SiO_2; Leucite to Orthoclose (q.v.), and Melilite to Anorthite (q.v.), with similar difference in silica content. They are all light-colored minerals, and occur in rocks of igneous origin, as original constituents in the phonolites, syenites, and many basalts.

Félegyháza, fā'led-y'-hä'zä, or KISKUNFÉLEGYHÁZA, town, Pest county, Hungary, between the Theiss and the Danube; 80 miles by rail southeast of Budapest. It has fruit, wine, and tobacco industries. Pop. 34,000.

Félibres, LES, lā fā-lēb'r', a society established by a band of poets and enthusiasts for the revival of the old *langue d'oc*, or Provençal language and literature. In 1854 the two chiefs of the school, J. Roumanille and F. Mistral (qq.v.), came together at Avignon; and in 1854 the Félibrige brotherhood was founded at the castle of Fontségugne (Vaucluse), including Aubanel (1829–86), and Félix Gras (1844–

91). An annual publication has been issued since 1855, annual meetings and fêtes being also held.

Felidæ, the cat family, includes the most specialized of the carnivores, especially characterized by the fact that the claws are retractile, that is, are lifted off the ground and enclosed in a sheath of skin on top of the toe, except when drawn forward and down for use. With the exception of the cheeta, or hunting leopard, all its members fall into the very large genus Felis, which includes all the cats, large and small. The Felidæ belong to the section Æluroidea of the order Carnivora, and are characterized by the fact that they have only thirty teeth, the formula being $\frac{3131}{3121}$. The carnassial teeth are large and well developed. Consult St. G. Mivart, *The Cat;* F. Simpson, *Book of the Cat;* E. H. Forbush, *The Domestic Cat.* See Carnivora, Cat, Lion, etc.

Feliu de Guixols. See San Feliu de Guixols.

Felix, name of several popes. Felix I (269–274) was a Roman by birth. He suffered martyrdom under Aurelian.—Felix III (483–492) was born in Rome. He was involved in the Monophysite controversy, and excommunicated Acacius, patriarch of Constantinople, and thus began the first breach between the Eastern and Western Churches.—Felix V (1439–49) was Amadeus, Duke of Savoy, who was set up as antipope by the Council of Basel in opposition to Eugenius IV, but resigned his dignity in 1449.

Felix, Antonius, a freedman of the Roman emperor Claudius, was procurator of Judæa from about 51 to 62 A.D. He induced Drusilla, wife of Azizus, king of Emesa, to desert her husband and join him. She was still living with him in 60 A.D., when St. Paul preached before him.

Fell, John (1625–86), English scholar, took up arms on behalf of Charles I. After the Restoration of Charles II he was made canon of Christ Church, Oxford, and chaplain to the king, being also created bishop of Oxford (1675). He restored the buildings of his college, and erected the 'Great Tom' tower. He edited the works of St. Cyprian and many editions of the classics. He expelled John Locke from Oxford, but did so very unwillingly. He was the subject of the epigram, 'I do not like thee, Dr. Fell,' etc.

Egyptian Fellahîn at Work.

Fellah, plural **Fellahîn** (Ar. 'ploughman; peasant; tiller of the soil'), the lowest class of freemen in Egypt, the descendants of the ancient Egyptians, with an admixture of Syrian, Nubian, and Arabian blood, who have mostly become Mohammedans. Racially the type is a high one, and physically the fellahîn are fine specimens of humanity. The color of the race ranges from almost black at Assouan to almost white on the Mediterranean coast. Although their position was somewhat improved under British rule, they still live in great poverty, with little social or political enlightenment.

Fellata. See Fulahs.

Fellenberg, Philip Emmanuel von (1771–1844), Swiss philanthropist and educational reformer, born at Bern. After extensive travels through Europe, he bought the estate of Hofwyl, near Bern, where he established model schools (still in existence).

Felling, tn., Durham, England, 2½ m. S.E. of Newcastle; has manufactures of paper, glass, and chemicals. Pop. (1931) 27,041.

Fellows, Sir Charles (1799–1860), English archæologist, born in Nottingham. He discovered (1827) a new way to the top of Mt. Blanc, which has been generally followed since. His life work, however, lay in Asia Minor, where he traced the course of the Xanthus, and identified many very ancient cities. His principal works were *An Account of Discoveries in Lycia* (1841), the *Xanthian Marbles* (1843), and *Coins of Ancient Lycia* (1855).

Fellowship. A university foundation designed for the support of students. The institution arose in the Middle Ages and originally was nothing more than a charitable foundation to defray

the cost of lodging and board for needy students; at a later period generally granted after tests of fitness. In the English universities, where the fellowship system attained its greatest development, the fellows were at first undergraduates, but gradually came to be chosen from those already holding the university degree. The English fellowship did not necessarily imply the performance of professional duties, nor residence at the university, except for a limited period each year. Fellowships are granted for terms varying from a short period to life tenure. Holders enjoy incomes ranging from £100 to £800, the use of chambers in the university and other privileges. In 1877 a reform was undertaken resulting in the substitution of prize or tutorial fellowships for the idle life fellowships.

In American universities fellowships are regularly distinctions conferred to enable students to pursue advanced graduate work as distinguished from scholarships (q.v.), though the term scholarship is occasionally used in this sense. They are usually endowed by private donors and produce incomes varying from $100 to $1,200, with an average of $500, tenable for terms of one to three years. They are usually open to graduates of other colleges, and are assigned either in competitive examination or as an honorary distinction. Holders are generally expected to pursue their studies at the institution conferring the fellowship and to perform certain duties. In some cases holders may be permitted to study at other institutions, and some fellowships are specifically intended for work in foreign schools. The number of endowed graduate fellowships is being rapidly increased. Most of the universities offer a definite number of special fellowships, and a number of undeterminate fellowships, depending on the standing and number of applicants. In 1906 Harvard offered 67 and the University of Chicago over 100 fellowships and graduate scholarships, and had foundations for an undefined number of others.

The term fellow is also used of a member of the governing body or trustees of a college, as at Harvard.

Felltham, Owen (*c.* 1602–68). English author, born in Suffolk. His chief work, *Resolves* (1620), is a series of moral essays written in Bacon's manner.

Felo de se. See Suicide.

Felon. Paronychia; Whitlow. A very painful suppurative inflammation at the base of the finger nail, or anywhere in the hand. The inflammation may be superficial, or very deeply seated. In the latter case it may be beneath the dense fascia of the palm of the hand, and the pus may be unable to reach the surface. Early incision is the only treatment; for if delayed the sheaths of tendons or joints may be involved, and irreparable mischief done. In some cases the pus burrows under the periosteum, and the pain is intense. Such a case is called a 'bone felon.' The trouble is a cellulitis, due to infection with pus germs, through a hair follicle, a sweat-gland or a scratch, in persons who are debilitated. After incision, a splint may be needed to prevent contractions which are likely to occur if a considerable cut heals with the fingers flexed.

Felony. See Crime and Criminal Law.

Felsite. Fine-grained, hard, compact, flinty-looking igneous rocks of acid composition have very generally been designated felsites. The microscope shows that many of the felsites consist of a mixture of feldspar and quartz in very minute crystals of irregular form. There has been much discussion as to the nature of this microfelsitic material. In some rocks it consists of minute fibres, arranged in divergent bunches; in others it is granular, and has a speckled appearance. It seems probable that many felsites were originally glassy obsidians or pitchstones, which in course of time have passed from the vitreous into the cryptocrystalline state. This change is known as 'devitrification.' *Apobsidian* and *aporhyolite* are preferable terms for this type. A *felsophyr* is a porphyritic felsite. *Quartz felsite* is often used as synonymous with quartz porphyry. *Soda felsites* contain soda feldspar, and a larger percentage of soda than usual.

Felspar. See Feldspar.

Felstone, a term formerly employed to designate fine-grained igneous rocks, which as a whole contained little obvious quartz, and at the same time were paler in color and had a lower specific gravity than the basalts and greenstones. They would now be regarded as trachytes, andesites, and porphyrites. Some authors regard felstone as synonymous with felsite.

Felt, a peculiar fabric obtained from woollen and other materials. The individual woollen hairs, unlike cotton or other fibre, are covered with innumerable serrations or teeth, which under the conditions stated become intimately locked together. Different kinds of wool vary greatly in this respect, some having no less than from 2,700 to 2,800 such serrations to the inch. All varieties of wool are not, however, capable of producing good felt, further essentials (beyond the property of extensive serration) being a wavy and crimpled form as well as the possession of elasticity and strength. Felt for carpets, coverings, etc., is manufactured by placing the requisite number of layers of wool that has been carded into laps on top of one another, and passing them in succession between heavy and hollow steam-heated rollers, while they are kept moist by immersion in warm water. A peculiar lateral motion is also given to these rollers, which materially assists the 'felting' process. Treated in this manner the fabric decreases in length and breadth, but increases in strength and power of withstanding a tearing strain. In the manufacture of felt hats the fibres employed are chiefly wool, fur, and silk. Among wools, merino or Australian wool is considerably esteemed for this purpose, the 'noils,' or short fibre combings, separated from the longer or worsted fibres of the combing-machine, being largely used.

Felt, Joseph Barlow (1789–1869), American historian, was born in Salem, Mass. He graduated at Dartmouth College in 1813 and for more than twenty years was pastor of Congregational churches in eastern Mass. For ten years, from 1836, he was engaged in classifying and arranging the state and colonial archives, which had fallen into great confusion. He was librarian of the Massachusetts Historical Society from 1842 to 1858, and held other positions in similar associations. His principal works are, *Annals of Salem* (1827); *History of Ipswich, Essex and Hamilton* (1833); *Historical Account of Massachusetts Currency* (1839); *The Customs of New England* (1853); *Ecclesiastical History of New England* (1855–62).

Felton, Cornelius Conway (1807–62), American scholar, was born at West Newbury, Mass., and graduated (1827) at Harvard, at which institution, after several years of service as tutor and professor, he became Eliot professor of Greek literature in 1834, and president in 1860. He visited Europe in 1853 and 1858, making a special study of Greece, both as to its antiquities and as to its modern characteristics. He prepared several Greek text-books, translated various French and German standard works, and published a revised edition of Smith's *History of Greece* (1855) with a continuation to modern times by himself. His *Familiar Letters from Europe* (1864), and *Greece, Ancient and Modern*, Lowell lec-

tures (1867), were brought out pos thumously.

Felton, JOHN (1595-1628), English assassin, is said to have been born near Sudbury in Suffolk. His failure to gain promotion in the army is said to have led him to assassinate the Duke of Buckingham at Portsmouth, Aug. 23, 1628, for which he was hanged at Tyburn.

Felton, SAMUEL M. (1809–1889), American engineer, born in West Newbury, Mass., and graduated at Harvard College in 1834. He became superintendent of the Fitchburg R. R. in 1843, and president of the Philadelphia, Wilmington and Baltimore R. R. in 1851. In 1861 he was informed of a plot to seize Washington just previous to Mr. Lincoln's inauguration, proclaim the Confederacy, and cut off all communication with the north by burning bridges and attacking trains. He organized guards all along the road as repairers, and by delaying the train and cutting the telegraph lines for twelve hours, enabled Mr. Lincoln to reach the capital in safety. In April, 1861, he organized the transportation of northern troops to Washington by way of Annapolis, when Baltimore had fallen into the hands of a mob. In 1865 he was elected president of the Pennsylvania Steel Co., in 1870 director of the Northern Pacific R. R., and in 1873 of the Pennsylvania R. R.

Feltre, tn., prov. Belluno, Italy, 34 m. by rail N.W. of Treviso. Pop. 15,243.

Felucca, the name of the largest and fastest sailing boat of the Mediterranean. It is decked, sits low in the water, and has a

Felucca.

high bow and raking stern-post. The rig consists of three masts with lateen sails and a jib.

Female Suffrage. See SUFFRAGE.

Feme, or FEMME, is the Norman-French term used in English law for a woman. 'Baron and feme' means husband and wife, and as the wife is under the protection and influence of the husband during the continuance of the marriage or coverture, she is called a *feme-covert.* An unmarried woman is called a *feme-sole.*

Femern. See FEHMARN.

Femoral Artery, the main artery conveying blood to the leg. It runs down the front and inside of the thigh, giving off large branches as it goes. It finally reaches the back of the thigh two-thirds down, where it becomes the popliteal artery

Femur. See LEG.

Fences. A fence, in an agricultural sense, is a barrier, commonly constructed of stone, rails, planks, pickets, or wire, surrounding or separating areas of land, and designed ordinarily to confine stock or prevent their depredations. Fence laws are variable in different regions, but, as a rule, in regions where the proportion of cultivated to uncultivated or grazing land is large, the laws require owners to fence in their stock; where the conditions are reversed they often require the owner of cultivated areas to fence out their neighbor's stock. Fencing is more general in the United States than in European countries. On the other hand, hedges are less used in America than in Europe. Rail fences, common under primitive conditions of abundant timber, are wasteful of land and timber, and are fast disappearing.

Stone fences still survive where stone is abundant, but are expensive and wasteful of land.

Sod fences are a makeshift used to some extent where other materials are lacking.

Picket fences, of both wood and iron, are frequently used, largely from ornamental considerations, and mainly for enclosing small areas, such as yards, gardens, etc.

Wire fences, plain, barbed, and woven, are extensively used in the United States, particularly in the Middle West. They are comparatively cheap, effective, durable, and easily constructed. Barbed-wire fences are liable, however, to injure stock, particularly when confined to small areas.

Hedges of hawthorn, osage orange, boxwood, privet, etc., are sometimes substituted for fences, but while ornamental and fairly effective are slow of growth, wasteful of land, and expensive.

The growing scarcity of timber makes it increasingly difficult to secure a suitable supply of posts for fences. For this reason the red cedar, black locust, white oak, chestnut, etc., formerly preferred for posts, are being abandoned for catalpa and similar quick-growing timber planted for this purpose, the durability of such posts being improved by treatment with preservatives, such as copper sulphate, hot creosote, etc.

Fên-chou-fu, city in Shan-si, China, near the r. bk. of the Fên, 37° 19′ N., 111° 41′ E.

Fencing. When the basket-hilt of the *schiavona* came into use in Britain, about half-way through the 17th century, the cudgel was sometimes used with such a hilt, as the foil of the backsword; and the word 'single-stick' bears the same relation to the staff, or two-handed stick, as the backsword did to the long two-handed sword. Such weapons as the poleaxe, used by Thomas Qué in the reign of Henry VI., or as the quarterstaff, can hardly be said to have assisted the development of fencing. But the backsword used by the 'prize-players' from the days of Charles I. onwards marked a very definite period. Samuel Pepys gives a vivid account of the fight between Matthews and Westwicke on June 1, 1663, and of three others in the next six years. These were in the style of fence described by Donald MacBane in Queen Anne's reign, which was practically confined to those who fought for money, and to the lower orders generally. James Figg, who fought three hundred battles on the stage, was its doughtiest exponent, and Captain Miller was a worthy rival. The latter's encounter with Timothy Buck is described in the *Spectator* for July 21, 1712. Buck soon cut Miller over the forehead, and then ended the fight by slicing his leg, which was sewn up before the company. The broadsword used by Rob Roy, and described by Sir Walter Scott as accurately as he depicts a two-hand fight in *Anne of Geierstein,* was a very similar weapon. The arrival of Angelo in London, and other sufficient reasons, brought the use of the point into vogue among gentlefolk. The use of the backsword foil was perpetuated in the singlestick, which was the chief attraction at the famous Dover's meetings, or at country gatherings; and even at Angelo's famous rooms in St. James's men did not disdain in the last half of the 19th century to have a brisk round of single-stick, guarded by nothing but a leathern helmet. At schools the practice is continued to this day. Those who care for this style of sword play should turn to the Italian school of Masiello. The Italian *sciabola* is one of the deadliest hand-weapons ever known. Its light, lithe blade is keen as a razor, with a short 'false edge' (on the wrong side) near the tip, and a point that doubles its effectiveness.

But it is with the use of the point alone that the true fencer is chiefly concerned. The foil he uses is a light four-sided steel blade with a conventional guard to the hilt, and a button on the point. It should be lissom enough to bend easily at a hit, but tough enough to keep fairly straight

Fencing

with good usage. Foil play is almost the only sport in which perfect form means irresistible effectiveness. It exercises the body not in one place only, but in every muscle, nerve, and tendon from heel to head. It does not confine its capabilities for improvement to wrist, or eye, or finger, though these three may be the most important; but it imparts an erect carriage to the head, a bracing action to the shoulders, and a full command of balance and equipoise to limbs and body.

Let us imagine a novice entering one of the modern *salles d'armes*. Dressed in a suit of flannel, the trousers somewhat more confined than usual about the ankles, but loose and free elsewhere, the tunic or jacket closely fitting, buttoned down the left side and fitted with a high, stiff collar, the beginner will get a pair of French fencing shoes, a mask of closely-meshed strong wire, a glove not too bulbously padded, and a pair of the best French foils.

Imagine, now, a young man, foil in hand, prepared for his first lesson. His body should be firm and upright, and his head erect. The legs cannot be straight, because they have to be ready for instant movement, and time would be lost if they had to be bent first. They cannot be close together, for they would give no solid basis for his balance. As he must be equally steady whether he is at rest, or is advancing, or is retiring, the weight of the body must be equally distributed upon bent knees, with the feet a little way apart. And the knees must not be merely slightly bent, they must be forced down some way, ready to spring. The right foot should be twice its own length in front of the left foot (we are speaking throughout of a right-handed fencer), and it should also be pointing straight forward in the direction of the foil's point, with its right heel exactly covering the left heel. When he stands on guard his legs should be so bent that if he drops his eyes his right knee will exactly cover his right foot, and his left foot will be exactly hidden by his left knee. In making a parry, knees and feet remain firm: in making a lunge the left foot clings tenaciously to the ground, with *every part* of the sole of the fencing shoe firmly planted on the floor. This is one of the most essential things in fencing and one of the hardest. Without it the lunge loses half its force and precision, and the recovery must inevitably fail in accuracy and balance. The right foot, when lunging, is only just sufficiently lifted to enable the heel to clear the ground. Though the whole weight of the body swings upon the right knee upon which it is forced down, its position (as regards the shoulders and head) remains as upright as before.

Try for accuracy and correctness first. Let speed come as an unconscious reward, and never lunge too far by overstriding

For a good six months stick to your teacher, and fence with no one else. For the next six months only fence with men who are better than yourself. Acknowledge instantly the faintest suspicion of a hit on any portion of your body by touching the spot with your left hand, for courtesy is the soul of fencing. For the

Paul's Photos, Chicago

FENCING MATCH

Keep the shoulders down, and the knuckles pointing to the floor, and never lose that delicate touch upon the foil which vanishes if you grip it too tightly, and which will turn your weapon into an elongated and exquisitely sensitive nerve if rightly used. When you have mastered the simple parries, and the simplest forms of attacking with the lunge, try the same movements blindfold.

same reasons never emphasize any hit you may imagine you have made. Keep an open mind as you approach every new adversary. Discover his weak points and remember your own. Beat him by skill, never by brute strength. Aim at precision in the simplest things. Perfect your disengage; make sure of serried parries and of accurate ripostes; be ready to engage on

either side; never let your feet get out of line nor your point off the target.

The two great fencing associations in America are the Amateur Fencers' League of America and the Intercollegiate Fencing Association. In the League there is a championship contest each year with foils, duelling swords and sabres, and it is contested by the winners in the various club tournaments in the large cities of America. The Intercollegiate Association is composed of the large colleges and the naval academy at Annapolis and the military academy at West Point. It also has an annual championship contest with foils only.

There are two books in which the development of the art is traced as it deserves: *Schools and Masters of Fence* (new ed. 1892), by Egerton Castle; and *The Sword and the Centuries* (1901), by Alfred Hutton.

One of the best technical volumes is the little treatise in the All England Series by H. A. Colmore Dunn. Those who wish to go deeper into the delicacies of the best French style should purchase *L'Escrime et le Duel* (1891), by C. Prévost and G. Jollivet. The beginner may also consult *Cold Steel* (1889) and *The Swordsman* (1891), by Captain Hutton. Burton's *Book of the Sword* (1884) remains a magnificent fragment. Mr. Egerton Castle's *Schools and Masters of Fence* contains the only complete bibliography of the sword, down to 1892. See SWORD.

Fénelon, FRANÇOIS DE SALIGNAC DE LA MOTHE (1651–1715), French writer and prelate, was born at the Chateau de Fénelon in Périgord. In 1678 he was appointed director of the Nouvelles Catholiques, a community of women recently converted from Protestantism—a post which he held for ten years. During this period he wrote the *Traité de l'Education des Filles* (1687), the *Traité du Ministère des Pasteurs* (1688), and the *Réfutation du Système de Malebranche* (first published 1820), with marginal notes by Bossuet. In 1685 he was sent on a mission to Poitou and Saintonge, to allay the disturbances in those provinces caused by the revocation of the Edict of Nantes. In 1689 he was appointed preceptor to the Duke of Burgundy, grandson of Louis XIV., for whose instruction he wrote the *Aventures de Télémaque* (1699), the *Dialogues des Morts* (four dialogues in 1700; eighty-one in the edition of 1823), and a volume of *Fables*. In *Télémaque* the story is skilfully adapted to illustrate simple political lessons, and these, along with the *Plan de Gouvernement* (1710), and the *Essai philosophique sur le Gouvernement civil*, enunciate Fénelon's political principles. He insists on the moral obligations of kingship, on the relation of the king as father to the people, for whose welfare alone he reigns, on the evils of luxury and ostentation, and the false glories of dominion and conquest. But this idea of paternal government, so far from being an anticipation of Rousseau, is essentially aristocratic. It is said that to the expression of these sentiments he owed his appointment to the archbishopric of Cambrai (1695). In answer to Bossuet's *Etats d'Oraison*, he published his *Explication des Maximes des Saints* (1697). Bossuet retaliated with the *Relation sur le Quiétisme* (1698), and finally obtained (1699) the condemnation by the Pope of twenty-three propositions taken from the *Maximes des Saints*. Fénelon at once submitted, thereby putting in practice the principles of his own *De Auctoritate*, which asserted the Ultramontane in opposition to the Gallican view of papal authority. At Cambrai he wrote the *Traité de l'Existence et des Attributs de Dieu* (1713–1718), and the *Lettre à l'Académie française* (1716). He had been elected a member of the French Academy in 1693. The critical importance of the *Letter to the Academy* is considerable. The versatility of Fénelon's mind reflected the complexity of his character. He is a mystic, a controversialist, a statesman, a literary artist, and a critic. He is not a deep, though often an original thinker, and his writings cannot compare in force and beauty of style with those of Pascal and Bossuet. In person he realized the ideal of a *grand seigneur*, refined and graceful, courteous, of high intelligence, and of noble thoughts; and in the union of these qualities lies the elusive but all-pervading charms of his writing. His other works are *Dialogues sur l'Eloquence* (1718); *Examen de la Conscience d'un Roi* (1734); *Mémoires concernant la Guerre de Succession d'Espange; Lettres sur divers Sujets concernant la Religion et la Métaphysique* (1718); *Œuvres*, ed. Gosselin and Caron (22 vols., 1820–30); *Correspondance*, ed. Gosselin (11 vols., 1827–9); *Œuvres* ed. Didot (3 vols., 1850). Nearly all his chief books have been translated into English. See Ramsay's *Histoire de la Vie et des Ouvrages de Fénelon* (1723); Gosselin's *Histoire littéraire de Fénelon* (1843); De Broglie's *Fénelon à Cambrai* (1884); P. Janet's *Fénelon* (1892); and Crouslé's *Fénelon et Bossuet* (1894).

Fêng-hsiang-fu, city in Shensi, China, on a branch of the Wei R., 34° 35′ N., 107° 50′ E.

Fêng-huang-chêng, tn., Sheng-king, Manchuria.

Feng-tien, LIAO-TUNG, or SHENG-KING, the southernmost prov. of Manchuria, washed by the Gulfs of Liao-tung and Korea. Area, 55,985 sq. m.; pop. estimated at over 4,000,000. The E. portion consists of forest-clad mountains and fertile valleys; the W. is drained by the Liao R. Mukden is the capital; Newchwang, 26 m. from the mouth of the Liao, was the old seaport, but is now an inland town, the present seaport being Ying-tse, at the mouth of the river. Between the Gulfs of Korea and Liao-tung stretches the peninsula to which the name Liao-tung was formerly restricted; near its S. extremity are Dalny (Ta-lien-wan) and Port Arthur. See RUSSO-JAPANESE WAR.

Feng-yang-fu, city in An-Hui, China, S. of the Huai R., 32° 54′ N., 117° 35′ E.

Fen-ho, the chief riv. of Shansi, China, joins the Yellow R. above Pu-chou-fu. It is only navigable in its lower course, and this is frozen in winter.

Fenianism, a movement of disaffected Irish and Irish-Americans to separate Ireland from Great Britain and form it into an independent republic. The first of the Fenian leaders was James Stephens, later called 'Head Centre Stephens,' one of the revolutionary exiles of 1848, who had taken refuge in Paris, and who, with the support of Irish sympathizers, subsequently organized a conspiracy and endeavored to stir up a rising in Munster. The 'Phœnix Conspiracy,' as it was called, failed; Stephens and some of his associates came to the United States, and found fresh followers among the descendants of those who left Ireland after the great famine of 1847. He and John O'Mahoney organized the movement on this side of the Atlantic. After the close of the Civil War, which cast thousands of adventurous Irishmen adrift, Fenian societies—so named from a Gaelic title—were formed more rapidly in many cities in the United States, and an invasion of Canada, known as the 'Fenian Raid,' was planned and partly carried out in 1866. Between 500 and 600 men crossed the Niagara River on June 1, and after a partial success at Ridgeway, a village in Welland co., Ont., were speedily driven across the river and many of them were arrested by the United States authorities. Other attempts made during the same year were checked before the adventurers could leave the American side of the boundary line. On May 25, 1870, however, a small Fenian force crossed the frontier at Trout River, in the province of

Quebec, but was driven back by the Canadian volunteers. In the meantime Fenian agitators had been active in Ireland. Attempts were made to corrupt British regiments stationed there; a minor portion of the Irish press preached war with the 'Saxon,' and thousands of Irish youths were attracted into the Fenian ranks. But the Catholic priesthood denounced the agitation and prevented the mass of the people from supporting it. It collapsed in Ireland in 1867, but in that year several outrages in England, especially a raid on the castle of Chester, an attack on the police at Manchester, and an attempt to blow up Clerkenwell prison in London, forced the British government to give its attention to Irish grievances and to carry out the reforms inaugurated by Mr. Gladstone from 1869 to 1873. Ten years later there was a new development, and Fenian societies in the United States and Ireland were divided into two main bodies, the Clanna-Gael and the United Irish Brotherhood, the former's members in the United States chiefly representing the 'terrorist' element, which sought to impress, in terms of force culminating in dynamite explosions, the British government with the danger of delay in granting Irish revolutionary demands. They attempted the blowing up of the British House of Commons, and committed other outrages in London in 1883. After the formation of the Irish Land League the members of Fenian societies, at the instigation of Michael Davitt, agreed to support it in its efforts to break the power of Irish landlords by inciting the tenants to refuse the payment of rents. There was a powerful branch of the league in the United States, and in response to the appeals of Pres. Davitt, it contributed large sums to the Irish Nationalist cause. The movement now wore a constitutional aspect, and has ever since retained it, though with a disposition to plot and threaten. The atrocious murder of Lord Frederick Cavendish and Mr. Thomas Burke, in Phœnix Park, Dublin, in 1882, excited the indignation of the civilized world against the fanatical members of Fenian societies, and was repudiated by the more moderate among them. Fenianism in the United States is no longer a disturbing force of any consequence, and in Ireland it is quiescent, awaiting the outcome of proposed British legislation. Its most notable exponent on this side of the Atlantic in recent years was O'Donovan Rossa, a man of strong words and drastic schemes, but personally of innocuous, and even agreeable character. The movement in Ireland and the United States has been neutralized by the more liberal attitude of both English parties toward Irish self-government, and by the increasing friendship between the United States and Great Britain. See McCarthy's *Ireland Since the Union* (1879); Rutherford's *Secret History of the Fenian Conspiracy* (1877); Savage's *Fenian Martyrs and Heroes* (1864), and Gibbons's *Proceedings of the First National Fenian Convention Held at Chicago*, 1863 (1863).

Fenn, George Manville (1831–1909), English novelist, born in London. He was the author of nearly two hundred books, and the writer of innumerable short stories. Most of these are tales of adventure suitable for boys. Some have been undertaken in collaboration with other writers, of whom Mr. Henty is the best known. Fenn's style is simple and flowing, and he has laid his scenes in many lands.

Fenn, Harry (1838–1911), American artist, born at Richmond, Surrey, England, where, and at Isleworth, he received his education. He came to the U. S. in 1857, and achieved considerable success as a painter in watercolor, and as an illustrator, being one of the founders of the American Water-color Society. He travelled extensively, and the fruits of his travels are to be seen in his drawings for *Picturesque America*, *Picturesque Europe*, and *Picturesque Palestine*.

Fennec, a small desert animal found in the arid plains of Africa, and remarkable for its very large ears, which are one of the chief distinctions between the fennec and its allies, the foxes. The head and body together measure about 15½ in., the tail 6¾ in.; while the ears are 3 in. long, and broad in proportion. Like the foxes, the fennec is a nocturnal, burrowing animal, and its diet is as varied as that of the former. The pale coloring harmonizes with that of the sands among which the animal lives. The specific name of the species of the Sahara is *Canis* (or *Fennecus*) *zerda*.

Fennel (*Fœniculum vulgare*), a hardy perennial herb belonging to the order Umbelliferæ, is a native of Europe. It is characterized by its erect stem, finely divided leaves, and, in late summer by its umbels of small yellow flowers, followed by elliptical fruit. The whole plant has a characteristic flavor and odor, and its leaves are much used in making sauces to accompany fish, and for garnishing. The stems are occasionally boiled and eaten as a vegetable. Propagation is easily effected, either by division or by seed. Eighteen inches should be allowed from plant to plant, and the tops should be cut off three times during the season. The sweet fennel (*F. dulce*) is more suitable for boiling as a vegetable. It should be kept blanched by earthing up round the basis of the stem to a height of four inches above the soil level. The sweet fennel is an annual plant, and only thrives in warm situations. The various species of ferula or giant fennel

Fennel

1, Flower; 2, fruit; 3, section of fruit.

are handsome, tall, hardy, herbaceous plants, well worth growing for decorative purposes. The N. African *F. tingitanum* is perhaps the best species. This is quite a tree in height, and its fine foliage, surmounted by some forty yellow umbels, gives it a fine and distinguished appearance. The dwarfed *F. commune*, from the Mediterranean countries, is also an ornamental plant.

Fens, a low-lying region of England, some 70 m. long by 30 m. wide lying around the Wash between Cambridge and Lincoln. It represents a shallow bay or basin, scooped out of the underlying clays by the sea. The soil consists of peat, principally in the W.; and of silt, principally in the E.; and is everywhere of great fertility, yielding heavy crops of corn and roots and excellent pasture for fattening cattle. The Bedford Level was drained in the 17th century, but the final and effective drainage of the Welland and Witham Fens was not accomplished until after the mid-

dle of the 18th century (1767–1807). It is computed that between the coming of the Romans into Britain and the present time nearly 70,000 acres have been reclaimed from the sea. The inhabitants of this region have always been noted for their staunch love of freedom. Boadicea ruled over a part of this country; it was here Hereward held out against William of Normandy; and here Cromwell recruited his formidable Ironsides.

Fen'ton, village, Michigan, in Genesee county, on the Shiawassee River and on the Grand Trunk Pacific Railway; 15 miles south of Flint. It is a shipping point for live stock, grain, and fruit. Manufactures include carriages, hydraulic pumps, cement, screens, and machinery. Pop. (1910) 2,331; (1920) 2,507.

Fenton, or GREAT FENTON, town, England, in Staffordshire; 3 miles southeast of Newcastle-under-Lyme. It is part of the parliamentary borough of Stoke-upon-Trent, and shares in the manufactures of the potteries—china and earthenware. Pop. 26,000.

Fenton, ELIJAH (1683–1730), English poet and translator, was born in Skelton, near Newcastle-under-Lyme, Staffordshire. He was secretary to the Earl of Orrery in Flanders, and later became tutor to his son. Pope engaged him to translate four books of the *Odyssey;* he also edited Milton.

Fenugreek, fen'ū-grēk, popular name for the leguminous genus Trigonella, of which the European *T. fœnum-græcum* is the best-known species. The fenugreek is cultivated as a fodder plant, and in India is eaten in a green state by the natives. Its bitter, oily seed, of peculiar odor, is employed in the East in curries and bread.

Fen'wick, GEORGE (1602-57), American colonist, was born in England, and went to America in 1636 as agent of Lords Say and Brook to take charge of the plantation of Saybrook, Conn. After a visit to England he returned in 1639, and as one of the owners and a representative of the others he governed the settlement until 1644, when he sold it to the Connecticut Association. He then returned to England and became a colonel in the army of Parliament and was appointed one of the judges of Charles I. In 1654–6 he was member of Parliament from Berwick.

Fenwick, SIR JOHN (*c.* 1645–97), English soldier and conspirator, took part in two assassination plots against William III (1695–6), for which he was beheaded.

Feodor I., fā-ô'dōr (1557–98), Czar of Russia, was the son of Ivan the Terrible, and last prince of the house of Rurik. See RUSSIA.

Feodor II., Czar of Russia, and son of Boris Godounov, succeeded his father when he committed suicide in 1605; but after the people had declared for the false Dimitri (Demetrius), he was deposed, imprisoned, and finally assassinated. See RUSSIA.

Feodosia. See THEODOSIA.

Fer'ber, EDNA (1887–), American writer, was born in Kalamazoo, Mich. She was educated in the public schools of Appleton, Wis., and at seventeen became a reporter on the Appleton *Daily Crescent.* She was subsequently employed on the Milwaukee *Journal* and Chicago *Tribune,* and became a frequent contributor of magazine fiction. Her published works, which attained great popularity, include: *Dawn O'Hara* (1911); *Buttered Side Down* (1912); *Roast Beef Medium* (1913); *Personality Plus* (1914); *Emma McChesney & Co.* (1915); *Fanny Herself* (1917); *Cheerful—By Request* (1918); *Half Portions* (1919); *The Girls* (1921); *Gigolo* (1922); *So Big* (1924); *Show Boat* (1926); *Cimarron* (1929); and *A Peculiar Treasure* (1939). Also co-author with George S. Kaufman of the following plays: *Minick* (1924); *The Royal Family* (1927); *Dinner at Eight* (1932); and *Stage Door* (1936).

Black Star Photo by Sanders

EDNA FERBER

Fer de Lance, fâr de läns', an extremely venomous snake (*Lachesis lanceolatus*) of Northern South America, which is closely related to the rattlesnakes, but has no rattle. It sometimes reaches a length of six to seven feet, is reddish brown in color, remarkably fecund, and an object of great dread.

Fer'dinand I. (1861–), former king of Bulgaria, was born in Vienna. Although elected by the Bulgarian Parliament as the successor of Alexander of Battenberg on July 7, 1887, his sovereignty was not formally recognized by the Porte and the Great Powers until March 1896. In October 1908, when Bulgaria proclaimed her independence of Turkey, he assumed the title of King. Ferdinand was the instigator of the Balkan League which precipitated the Balkan Wars (q.v.). During the Great War he formed an alliance with Germany and following Bulgaria's withdrawal from the war abdicated in favor of his son Boris. He was twice married: to Marie Louise, daughter of Duke Robert of Parma, and to Eleanor of Reuss.

Ferdinand I. (1865–1927), king of Roumania, was born in Sigmaringen, Prussia, the nephew of Charles I. of Roumania. In

1889 he was elected heir-presumptive by the Roumanian diet and in 1893 he married Princess Mary (Marie), daughter of the Duke of Edinburgh, by whom he had five children, two boys and three girls. In 1914, on the death of his uncle, he became king of Roumania.

Ferdinand I. OF CASTILE (*c.* 1000–65), a Navarrese prince, second son of Sancho the Great of Navarre. After civil war with Bermudo III. of León, who also claimed the province of Castile, Ferdinand married Bermudo's sister, and was recognized first king of Castile in 1033. On the death of Bermudo of León (1037) Ferdinand claimed León, and, having won the battle of Atapuerca (1054) over his brother, Garcia of Navarre, annexed a large part of his dominions. At his death Ferdinand divided his states between his three sons, leaving thereby a long heritage of civil war.

Ferdinand II. OF LEÓN (1136–88), a younger son of Alfonso the emperor, king of Castile and León, inherited the latter kingdom on the death of his father (1157). He waged constant wars with the Moorish Almohades, and with his nephew's realm of Castile, and in 1179 defeated his father-in-law, Alfonso I. of Portugal, at Badajoz.

Ferdinand III., SAINT FERDINAND OF CASTILE AND LEÓN (1200–52), son of Alfonso IX. of León, by Berenguela (Berengaria), afterward proclaimed queen of Castile (1217). He became king of Castile and León, and these crowns were never afterward separated (1230). Ferdinand was chiefly occupied in wars against the Moors, capturing Ubeda (1234) and Cordova (1236), subduing Granada, and establishing his capital in Seville (1248). One of the greatest of Spanish kings, he initiated the famous codification of the Latin and Gothic laws known as the *Fuero Juzgo*, completed by his son, Alfonso X., the Learned.

Ferdinand I. OF ARAGON (1379–1416), surnamed Ferdinand the Just, was by birth a Castilian prince, son of John I. of Castile. On the failure of the male line of Aragon by the death of Martin the Humane (1410), Ferdinand was elected by the united Cortes of the states (Catalonia, Aragon, and Valencia) to be king (1412).

Ferdinand V. (1452–1516), king of Spain, was the son of John II. of Aragon. In 1469 he married Isabella of Castile, and on the death of her brother Henry IV. (1474) was proclaimed with her sovereign of Castile and León. On the death of his father, he succeeded to Aragon (1479), and in 1512 he conquered the main part of Navarre, adding it to his realm. During his reign the judicature was reformed, violence sternly suppressed, feudal castles razed to the ground, royal grants revoked, the religious orders of knighthood forced to surrender their vast landed estates and revenues to the crown, and the privileges of the towns extended. Spain was still disunited and for lack of other bonds of union, that of religious exclusiveness was adopted deliberately by Ferdinand and Isabella, with their great minister, Cardinal Ximenes. The conquest of the last Moorish kingdom in Spain (Granada) was undertaken (1482–92) with all the fervor of a crusade, and the cruel persecution, spoliation, and expulsion of Jews (1490-92) was equally a matter of policy and a source of revenue. The establishment of the new form of Inquisition by the 'Catholic kings' (1478), and the violation by them of their pledge of toleration to the conquered Moors, were popular in Spain, because they promoted the spiritual pride of orthodox Spaniards. When Columbus appealed to Ferdinand and Isabella for aid in his voyage (1486–92) he found Ferdinand cool, but Isabella pleaded his cause, and Columbus obtained concessions and promises which, however, were never fulfilled. Ferdinand aimed at the formation of a great European coalition, and in pursuance of this idea he seized Naples, and outwitted or defrauded most contemporary potentates, including Henry VII. of England. By marrying his eldest son, Juan, to the daughter of the Emperor Maximilian; his second daughter, Juana, to Philip, sovereign of Burgundy and Flanders, and heir of the emperor; and Catherine, his youngest daugher, to the heir of England, he seemed to have surrounded France on all sides with his allies; while by the marriage of his eldest daughter, Isabella, to the heir of Portugal, he made himself secure at sea. All came to naught, however, by the untimely death of his children, and he was succeeded by his grandson, Charles, sovereign of Burgundy, Franche-Comté, Flanders, Holland, most of Italy, and afterward of the empire. Isabella died at Medina del Campo in 1504, and Ferdinand at Madrigalejo. Consult Prescott's *History of the Reign of Ferdinand and Isabella.*

Ferdinand VI. OF SPAIN (1713–59), second son of Philip V., the first of the Bourbon line in Spain, succeeded in 1746, and at once brought to an end the destructive wars long waged by Spain to forward the projects of Elizabeth Farnese, second wife of Philip V. Aided by enlightened ministers, Carvajal and Ensenada, Ferdinand made great and successful efforts to revive art, science, and literature in Spain, and to follow a truly national policy.

Ferdinand VII. OF SPAIN (1784–1833), eldest son of Charles IV. by Maria Luisa of Parma. In 1808 he connived at the rising that overthrew Godoy, and caused the dissensions in the royal family that gave Napoleon a pretext for the Peninsular War. By the forced abdication (afterward retracted) of his father in 1808 Ferdinand became king; but by the cunning of Bonaparte he was enticed across the frontier to Bayonne, and kept prisoner at Valençay during the war. The government of National Defence at Cadiz (1812) adopted a democratic constitution. Ferdinand, forced to promise to respect it, broke all his pledges on his return to Spain (1814), and an era of rigid despotism succeeded. He repealed the Salic law to enable his daughter (Isabella II.) to succeed him. His brother, Don Carlos, protested, and Ferdinand's death was the signal for the first Carlist War. During Ferdinand's reign Spain lost the greater part of its possessions in North and South America.

Ferdinand I. (1503–64), Holy Roman Emperor, was born in Alcalá de Henares, Spain. As the brother of Charles V., Ferdinand was given the government of all the Austrian lands, together with certain claims upon Hungary and Bohemia. In 1526, on the death of Louis, king of Hungary and Bohemia, at Mohácz, Ferdinand, who had married the sister of Louis, claimed the vacant crown. Bohemia he easily secured; but, though crowned at Stuhlweissenburg, he was unsuccessful in Hungary against a rival, John Zápolya, and eventually much of the territory was seized by the Turks. He aided Charles in Italy, and on the latter's behalf made the treaties of Passau (1552) and Augsburg (1555). He successfully opposed Charles V.'s plan of making his son Philip emperor, and was himself elected (1556) to the dignity.

Ferdinand II. (1578–1637), Holy Roman Emperor, was born in Graz. As a pupil of the Jesuits, he was strongly opposed to the Protestants and to toleration. In 1617 he was recognized as heir to the Bohemian throne, and in 1619, on the death of Matthias, was also elected emperor. The Bohemians, however, deposed Ferdinand, and elected Frederick Count Palatine to the Bohemian throne. Out of this grew the Thirty Years' War, in

the early stages of which Ferdinand was successful. Hitherto he had relied upon the Catholic League, guided by Maximilian of Bavaria; he now relied upon Wallenstein, who, at the head of a powerful army, endeavored to make the Hapsburgs supreme throughout Germany. Though Christian IV. of Denmark was overthrown in 1626 by Tilly and the army of the League, Wallenstein was, in 1628, checked before Stralsund. Ferdinand's fortunes then began to decline, and in 1632 he was totally defeated at the battle of Lützen. The invasion of Gustavus Adolphus, the jealousy exhibited toward Wallenstein by the German princes, the intrigues of France, and the assassination of Wallenstein, destroyed Ferdinand's hope of crushing Protestantism. Though in 1634 he defeated Bernhard of Saxe-Weimar, and in 1635 made the Treaty of Prague with Saxony, his reign ended in failure and misfortune.

Ferdinand III., Holy Roman emperor (1637–57), was born in 1608 in Graz, the son of Ferdinand II. After Wallenstein's assassination he was made imperial generalissimo, defeated the Swedes at Nördlingen, but continued the Thirty Years' War with France until 1648. In that year a series of disasters forced him to make peace. Bavaria was conquered by the French (May), the Swedes took Little Prague (July), and Condé won the battle of Lens (August). On Oct. 24, 1648, the peace of Westphalia was signed. Henceforward the Hapsburgs placed Austrian interests above those of the empire as a whole.

Ferdinand III. (1769–1824), Grand Duke of Tuscany and Archduke of Austria, second son of the Emperor Leopold, in 1790 succeeded his father in Tuscany, and continued his reforming policy. In 1793 he declared war on the French republic, but on Feb. 9, 1795, peace was made. Despite Ferdinand's desire to remain on good terms with France, Florence was occupied by French troops in March, 1799. The successes of the allies later in that year led to the restoration of Ferdinand; but by the treaty of Lunéville (1801) Tuscany was formed into the kingdom of Etruria. In the reconstitution of Germany in 1803, Ferdinand was named elector of Salzburg, which territory and dignity he exchanged a few years later for the grand-duchy of Würzburg. By the Congress of Vienna (1814–15) Ferdinand was restored to the grand-duchy of Tuscany.

Ferdinand I. (1751–1825), king of the Two Sicilies, a man of weak character, the third son of Charles III. of Spain, was born in Naples. He became king of Sicily (and Naples) in 1759, but was entirely ruled by his high-spirited wife, Marie Caroline of Austria, sister of Marie Antoinette. In 1806 Napoleon gave Naples to his brother Joseph but Ferdinand was restored in 1815, and was compelled by the Carbonari to grant Naples a free constitution. However, with the help of Austria, he again set up a despotic monarchy.

Ferdinand II. (1810–59), grandson of Ferdinand I. of the Two Sicilies, began his reign (1830) by granting the Neapolitans a constitution; but under the influence of his second wife, Theresa of Austria, he relapsed into absolutism, thereby provoking incessant revolts, which he suppressed with ruthless cruelty. His nickname of 'Bomba' originated during his bombardment of Messina in 1849.

Ferdusi. See FIRDAUSI.

Ferentino, fā-ren-tē'no, town, Italy, in the province of Rome; 48 miles by rail southeast of Rome. It has interesting antiquities, and markets wine and oil. Pop. 13,000.

Fergana, fer-gä'nä, or FERGHANA, former province of Russian Central Asia, formed from the old khanate of Kokan or Kokand in 1876; area 35,654 square miles. It is in the main a rich, undulating, well-irrigated plain, enclosed by mountains. On the northwest it is bounded by an outlier of the Ala-tau; on the east and south by the Tianshan. Nearly the whole of Fergana belongs to the basin of the Syr Daria. Rice, maize, cotton, grapes, and melons are raised and there are rich mineral deposits, such as iron, lead, coal, quartz, silver and petroleum, hardly worked as yet. Besides Uzbegs, Tajiks and Kirghiz, the three principal races, there are also Persians, Kashgaris, Afghans, Hindus, Tartars, Jews, Tsiganes (Gypsies), and a steadily growing number of Russian colonists. In 1921 the eastern part became a part of the Kirghiz Socialist Soviet Republic and the western part a part of the Uzbek Socialist Soviet Republic.

Fergus Falls, city, Minnesota, county seat of Otter Tail County, on the Red River of the North, and on the Northern Pacific and the Great Northern Railroads; 170 miles northwest of Minneapolis. It has abundant water power, utilized in the manufacture of flour, textiles, iron goods, and sashes and doors. It also has a packing plant and silo and tile factories. It is the seat of Park Region Lutheran and Northwestern colleges (both Scandinavian), a State hospital for the insane, St. Luke's Hospital, and a Carnegie library. There are forests of pine and hard woods in the vicinity. It was chartered as a city in 1863. Pop. (1940) 10,733.

Ferguson, ADAM (1723–1816), Scottish philosopher, was born in Logierait, Perthshire. He was educated at the Universities of St. Andrews and Edinburgh and after a period as chaplain in the army devoted himself to more literary pursuits. In 1759 he became professor of natural philosophy, and in 1764 professor of moral philosophy, at Edinburgh University. He afterwards travelled with the Earl of Chesterfield, and in 1778 went to America as secretary to the commissioners sent by England to negotiate a settlement between that country and the American Colonies. After reaching Philadelphia, Washington refused him a passport to Congress, and he returned to England with the commissioners the latter part of the same year. His chief works are *History of the Progress and Termination of the Roman Republic* (1782), *Institutes of Moral Philosophy* (1772), and *Principles of Moral and Political Science* (1792).

Ferguson, ELIZABETH (1739–1801), American poet, was born (Graeme), near Philadelphia. She is known as the author of an unpublished metrical translation of Fénelon's *Télémaque*, and some of her verse is included in the *Poems* of Nathaniel Evans.

Ferguson, HON. GEORGE HOWARD (1870–), Canadian public official, was born at Kemptville. He was called to the bar in 1894 and first elected to the provincial legislature in 1905. He was minister of lands, forests and mines in the Conservative administration from 1914 to 1919 and after their defeat became leader of the Conservative party in 1920 and premier and minister of education after the triumph of his party at the polls in 1923. His administration was sustained at the general election of Dec. 1, 1926, which was fought largely upon the issue of Government liquor stores versus the previous policy of prohibition.

Ferguson, JAMES (1710–76), Scottish astronomer, was born near Rothiemay, in Banffshire. He was poor and supported himself by making portraits but in 1743 he went to London where he became a successful lecturer in astronomy. Among his inventions may be mentioned the *Trajectorium Lunare* (1744), and the *Eclipsareon* (1754). He was elected a member of the Royal Society in 1793, and received a pension from George III. Many of his books on astronomical subjects attained a wide circulation.

Ferguson, PATRICK (1744–80), Scottish inventor and soldier, was born in Pitfour, Aberdeenshire. He is mainly known for

his invention of a breech-loading rifle (1776), which could be fired seven times in a minute. He went to America in 1777, formed a corps of riflemen, armed them with breech-loading rifled carbines, demonstrated the value of his invention at the battle of Brandywine (1777), and later took a prominent part in the war in the Carolinas. He was defeated by the Americans and killed in action at King's Mountain, Oct. 7, 1780.

Ferguson, ROBERT (*c.* 1637–1714), Scotch political writer, called 'the plotter,' was born in Badifurrow, Aberdeenshire. He entered the ministry but was compelled to leave the living of Godmersham, Kent, by the Act of Uniformity (1662), and for his suspected share in assassination plots against the king was outlawed (1683). He then accompanied Monmouth in his descent on the west of England, and was present at Sedgemoor, from which he escaped to Holland (1685). His writings include *History of the Revolution* (1706); *Qualifications Requisite in a Minister of State* (1710); *A History of All the Mobs, Tumults and Insurrections in Great Britain* (1715).

Ferguson, SIR SAMUEL (1810–86), Irish poet and antiquary, was born in Belfast. He was called to the Irish bar (1838), and made deputy-keeper of public records for Ireland (1867). In 1865 he published *Lays of the Western Gael* in which, and even more in *Congal*, which followed (1872), and in a volume of *Poems* (1880), he showed himself a pioneer of the 'Celtic revival' in literature. Another side of his intellectual activity was shown in his posthumously published work on *Ogham Inscriptions* (1887); and in the same year were published three series of *Hibernian Nights' Entertainments*, including many of his most characteristically 'Celtic' poems; also *The Remains of St. Patrick* (1888), the translation of whose 'Confession' had been one of the most important tasks of Ferguson's later years. *The Forging of the Anchor* (one of the most spirited of the poems of 1880) was republished separately in 1883. He was remarkably successful in reproducing the spirit of ancient Celtic poetry.

Fergusson, JAMES (1808–86), Scotch historian of architecture, was born in Ayr. He early went to India where he made a fortune and retired from his indigo factory to devote himself to archæological studies, and wrote the monumental *Rock-cut Temples of India* (1843), *Ancient Buddhist Architecture of India* (1848), and the like. In a collection of Indian marbles excavated but lost sight of, which he rediscovered, he gained an insight into Indian 1st and 4th century mythology and art, leading to his *Fire and Serpent Worship* (1868). His interest in the ancient topography and buildings of Jerusalem was no less keen, but his fame now rests chiefly on three volumes of *A History of Architecture* (1865–7), and a fourth on *The History of Indian and Eastern Architecture* (1876).

Fergusson, ROBERT (1750–74), Scottish poet, was born in Edinburgh. He became an extracting clerk in the commissary clerk's office, Edinburgh, a position he held until his early death. His earliest published verses were contributed to Ruddiman's *Weekly Magazine* (1771–2). A volume of his collected verse, published in 1773, gave indications of possibilities which might have given him a high place among the poets of his time; but his health was already broken, and he died in the city madhouse.

It was the perusal of Fergusson's poems that revived, at a critical period, Burns' flagging interest in the muse. Many echoes of Fergusson's sentiments and style are to be found in Burns, who also manifests preference for Fergusson's favorite staves—those of *Habbie Simson* and *Christis Kirk*. The earliest posthumous edition of Fergusson's poems was *Poems on Various Subjects*, with a short life, by T. Ruddiman (1779).

Fergusson, SIR WILLIAM (1808–77), Scottish surgeon, was born in Prestonpans. He was educated at the University of Edinburgh, and after acting as surgeon at the Royal Infirmary, he went to London about 1840, where he held the professorship of surgery at King's College (1840–70), and became the leading London surgeon. He invented many surgical instruments still in use, and wrote the important *System of Practical Surgery* (1842, many editions).

Feriæ, fē'ri-ē, the name given to sacred festivals by the ancient Romans. They were of three kinds—fixed festivals, which occurred annually on the same dates every year, such as the Lupercalia or Saturnalia; festivals which were indeed annual, but whose date was fixed each year by the magistrates or priests —for example, the *feriæ Latinæ*, or great Latin festival, and the *compitalia;* lastly, special festivals celebrated by order of the magistrates in times of danger or triumph, for special worship of the gods. The *feriæ* were observed by the performance of prayers and sacrifices; no business at all being allowed while they lasted. There were forty-five fixed festivals every year.

Feringhi, fer-ing'gē, a corruption of *Frank*, the Oriental term for Europeans. All who spoke French were called Franks by the Byzantines, from whom the Saracens learned the term during the crusades. In India a Feringhi, or more properly Farangi, is a native-born Portuguese, and also a European generally; hence Farangistan, 'Europe.'

Ferishta, fer'ish-tä, or FERISHTAH, MOHAMMED KASIM HINDU SHAH (*c.* 1550–1612), Persian historian, was born in Astrabad, Persia. At an early age he accompanied his father to Ahmednager in the Deccan, India. In 1589 he proceeded to Bijapur, where in 1593 he was commanded by Ibrahim Adil II. to write a history of the Mohammedans in India. A draft, completed in Persian in 1606, was later revised, supplemented, and translated.

Fermanagh, fer-man'ä, inland county of Ireland, south of Donegal; area, 655 square miles. Upper and Lower Loughs Erne (salmon and eel fisheries), connected by the Erne River, form its principal scenic feature. The surface is hilly or mountainous. Agriculture is the principal industry. The lower lands (rich loam) are fertile; 12 per cent. of the area is bog marsh, and mountain. The county contains ancient castles, raths, and tumuli. There are famous pottery works at Belleek. The chief town is Enniskillen. Pop. (1937) 54,569.

Fermat, fer-mä', PIERRE DE (1601–65), French mathematician, was born in Beaumont-de-Lomagne, near Montauban, and in early years studied with Pascal. He became (1631) a councillor for the Parliament of Toulouse, but devoted his leisure time to the study of mathematics. He contributed to geometry a rule which to some extent anticipated the differential calculus; made a notable advance in the theory of numbers which had been stationary for a thousand years; and his correspondence with Pascal, relating to a game of chance, was the germ of the theory of Probability.

Fermentation, in its wider aspect, includes a large number of chemical actions that are brought about either by minute living organisms or by certain unorganized products of animal or vegetable life. Chemically, the changes taking place tend towards the simplification of existing compounds, and are usually either—(1) simple decomposition, (2) oxidation, (3) hydrolysis, and (4) a rearrangement of the molecule. Thus the principal action of the yeasts is to break up sugar (glucose) into alcohol and carbon dioxide; the lactic ferment, to split up glucose

into lactic acid, which by other organisms (*Bacterium subtile* and *B. butyricum*) is further decomposed into butyric acid. Of the second class, *Mycodema aceti* and *B. aceti* bring about the action between dilute alcohol and oxygen, forming acetic acid, and the nitrifying organism of the soil causes the oxidation of ammonia to nitrous and nitric acids, while the action of *B. ureæ*, in converting urea into ammonia and carbon dioxide is an example of hydrolysis. Besides these cases, where the chemical change is in the main a simple one, there are many more complex cases, such as the influence of bacteria in putrefaction, in digestion, and in causing disease, of which the chemistry is as yet little understood. The organisms that bring about these changes are low forms of plants of three kinds—*viz.* (1) the microbes of bacteria, comprising such forms as bacilli, micrococci, spirilla, etc., which are exceedingly small single cells that usually multiply by division; (2) the yeasts, which are also single but somewhat larger cells, that multiply by budding; and (3) the moulds, which have many cells, branch freely, and multiply chiefly by spores—a method of reproduction that under special circumstances is also followed by the bacteria and yeasts.

In order to bring about the various changes of which they are capable, these organisms must not only be alive, but growing. With ll, the temperature must be favorable, action taking place best at a little above atmospheric temperature, while at higher or lower temperature growth is checked, and at anything approaching the temperature of boiling water the organism is killed. Some organisms require air, others do not, but all require the presence of moisture and suitable food. Certain substances or 'antiseptics,' like acids

COMMON FERMENTS

A, Yeast (*Saccharomyces cerevisiæ*); B, Bacterium butyricum; C, Bacterium aceti, involute form; D, Bacterium subtile, with spores.

alcohols, formaldehyde, carbolic acid, or mercuric chloride, if present in sufficient quantity, kill the organism. Thus yeast will not continue fermenting sugar after the alcohol formed has reached 14 per cent, and in making lactic and butyric acids, chalk must be added to neutralize them as soon as formed.

Besides these organisms, there are some complex nitrogenous compounds obtained from plants and animals which, though dead and unorganized, bring about similar actions. These unorganized ferments, or *enzymes*, may be distinguished from the bacteria, yeasts, etc., by the fact that they cannot be separated from solution by filtration, and though destroyed by heat, stand a higher temperature than the organized ferments. The principal groups into which they are divided are—(1) *amylolytic enzymes*, such as the diastase of malt and the ptyalin of the saliva, which convert starch into dextrin and sugar; (2) *proteolytic enzymes*, such as the pepsin of the gastric juice and the trypsin of the pancreas, which convert insoluble proteids or albuminoids into soluble proteoses and peptones; (3) *enzymes which decompose glucosides* with the production of sugar, such as the myrosin in mustard seed, and emulsin or synaptase in almonds; (4) *coagulative enzymes*, such as that in rennet, which clots milk; and (5) *inverting enzymes*, or invertases, by which sugars of the sucrose type are transformed into simpler sugars, or glucoses.

For further information, see Frankland's *Our Secret Friends and Foes* (1894); Newman's *Bacteria* (2d ed. 1900); J. R. Green's *The Soluble Ferments and Fermentation* (2d ed. 1901); and Lafar's *The Utilization of Microorganisms* (1888–1903).

UNDERSURFACE OF MAIDENHAIR FERN LEAFLETS
The spore-cases are borne under the flaps.

Fermo, tn. and archiepisc. see, prov. Ascoli Piceno, Italy, 4½ m. from the Adriatic, and 37 m. by rail S. S. E. of Ancona. Pop. 20,542.

Fern, any species or plant of the order Filices, which contains the principal part of the vascular cryptogams. In the Linnæan classification the horse-tails, club-mosses, and selaginellas were also included, but since the days of Jussieu these have been regarded as forming distinct classes, and some botanists separate the moon-

worts, on account of the fructification being developed on a branched spike. Ferns spring from a creeping root-stock, from the lower portion of which roots are sent off, and from the upper portion the leaves arise. The leaf-buds are rolled up in a characteristic manner, like the upper part of a crosier, whence the vernation is said to be circinate; and the leaves grow at the tip till they have attained their full size. The leaves may be simple—that is, undivided—as in the hart's-tongue, but are commonly divided, as in the bracken and polypody, which are so well known. In the tree-ferns of tropical and subtropical countries the stem, resembling in appearance that of a palm tree, is formed by the coalescence of the bases of the leaf stalks. The leaves develop from the terminal bud, forming a rosette at the top; and when they die down and fall, leaf-scars form on the stem. If, in summer or in autumn, the under surface of a leaf of the common bracken be examined, there will be seen along the margins the sori or groups of spore cases, covered with a protective membrane or indusium. On the under side of the leaf of polypody these spore cases form circular patches of a golden-orange or brown; and in the male fern they are arranged in two rows on the basal part of the pinnules or leaflets. The form and arrangement of the spore cases, and the presence or absence of a protecting membrane, are used as characters by which to classify ferns into groups or families. When the spores are liberated by the rupture of the spore cases or sporangia, each of those that germinate gives rise to a prothallus, which sends off root hairs from its under surface, and vegetates for several months, eventually giving rise to male and female organs called respectively antheridia and archegonia. The antherozoids which escape from the antheridia fertilize the female organs, but in no case does the prothallus bear more than one fern plant. The fertilized female cell divides into four parts: from one the root is formed, from the second the stem and leaf, and the remaining two unite and develop into the foot by which the young fern is connected with the prothallus. Thus while the ferns of popular language are generally incapable of direct reproduction, and need the intervention of a sexual generation in order to perpetuate the race, they can occasionally arise by budding, from the prothallus or directly from the fern leaf, without the formation of spores (apospory).

Ferns are widely distributed from temperate to tropical climates, and the number of living forms is probably about three thousand. They are abundant in tropical forests as epiphytes, living on, but not deriving nourishment from trees. One of the finest species is the royal fern (*Osmunda regalis*) (q. v.), which sometimes reaches a height of from eight to ten feet. Fern remains are known from very early geological times; one genus (Eoptelis) occurs about the middle of the Silurian period; tree-ferns are met in the Devonian, as well as ordinary ferns closely allied to living forms; while they must have been abundant in Carboniferous times, though from this point they dwindle in numbers as higher forms of plant life were gradually evolved (Pteridospermeæ).

Ferns are largely cultivated in gardens and houses as decorative plants, on account of the graceful character of the foliage. Dried bracken is sometimes used for bedding down horses and cattle, and for thatching; the starch contained in the root-stocks has been utilized for food in times of scarcity, and more generally by races of low culture. The taro-flour obtained from the root-stock of a species closely allied to the common bracken was used by the Maoris till New Zealand was colonized. The oil of male fern, used as a vermifuge, and capillaire, a syrup extracted from the root-stock of an American species of maidenhair, are the only two fern products now used in medicine.

Culture of Ferns.—Hardy ferns will thrive for the most part under ordinary garden conditions in ordinary garden soil, but most prefer partial shade, abundance of leaf-mould in the soil, and a fair degree of moisture. Among those to which shade is not so essential are the various *Osmundas*, *Pteris aquilina*, *Onoclea sensibilis*, and *Dicksonia pilosiuscula*. Ferns should preferably be transplanted in early spring or late autumn, during the periods of least activity.

In growing the more tender species of ferns under glass, care should be taken to maintain uniformity in moisture and temperature, for nothing is so fatal to success as sudden changes in these matters. Ventilation must be free, and adequate shade must be afforded. Most ferns do well in comparatively small pots, but they should not be so cramped as to remain long pot-bound. Efficient drainage is of great importance: abundance of water should therefore be given throughout the summer. A good general compost for ferns is made by mixing together four parts fibrous loam, one part peat, two parts leaf-mould, and one part sand and charcoal. See Durand's *Field Book of Common Ferns*; Underwood's *Ferns and Their Allies*.

Photos by Raymond E. Janssen

FOSSIL IMPRESSIONS OF VARIOUS FORMS OF FERN LEAVES

Fern, Male. See Male Fern.

Fernandez, Juan (1538–1602), a Spanish navigator and discoverer of the two islands off the Chilean coast bearing his name (1563). It is reputed that in 157[illegible] he saw a continent which must have been either Australia or New Zealand.

Fernandez de Avellaneda, Alonso, the assumed name of the author of the spurious second part of *Don Quixote*, which appeared in Tarragona in 1614. Avellaneda's *Quixote* was extremely amusing and vigorous; but Cervantes in the real second part flagellates his imitator furiously. See the introduction, by J. Fitzmaurice Kelly, of Ormsby's *Don Quixote* (1901).

Fernandina, city, Florida, county seat of Nassau county, on Amelia Island, at the mouth of the Amelia River, 27 miles N.E. by N. of Jacksonville, on the Seaboard Air Line Railroad, and on the Intercoastal Waterway between Key West and New York. It is the only exporting port in the United States for hard rock phosphate, shipping it to all parts of the world. It is a popular summer resort and has one of the finest beaches in the world. The chief catch are shrimp, oysters and fish. Manufactures include fish fertilizer, stock food and fish oil, boat building, and the manufacture of kraft and rayon pulp from slash pine. Its history began about 1564 and progressed under at least eight different flags. Pop. (1930) 3,023; (1937) 3,931.

Fernando de Noronha, island in the S. Atlantic, 125 miles N.E. from Cape S. Roque in Brazil. It is 7 miles long by 1½ miles broad. Other islets lie nearby. It is a Brazilian penal settlement and has a population of about 2,000, all males and mostly convicts, guarded by a garrison and defense forts.

Fernando Po, island in the Gulf of Guinea, about 25 miles west of the Cameroon Coast. It has an area of 780 sq. miles; population 34,200, Europeans, Bantus and Negroes. Santa Isabel (pop. 9,000) is the capital. It is one of the most fertile areas of West Africa. With Little and Great Elobey, Annobon, Corisco and other isles, and the district of Rio Muni on the mainland, it forms the colony of Spanish Guinea. The island is densely wooded, large monkeys are common, and there are wild sheep and goats. The exports are palm oil, coffee, cacao, sugar, tobacco, rubber and vanilla. Discovered late in the 15th century by a Portuguese navigator, Fernãodo Po, the island was ceded to Spain in 1778. In 1827 the administration was handed over to Great Britain and a British "superintendent" was appointed. In 1844 Spain reclaimed the island, but appointed a British resident. Hence English is still largely spoken around the coasts.

Fernel, JEAN FRANCOIS (1497–1558), noted French physician, mathematician, and astronomer, achieved scholarly significance by accurately measuring a degree of the meridian. Later his personal inclinations led him into medicine, and he became physician to Henry II. His many medical writings, which exhibited Greek and Latin influences, gave rise to the popular label describing him as "the modern Galen."

Ferney, or FERNEY-VOLTAIRE, town, capital of the department Ain, France, at the foot of the Jura Mts., 4 miles N.W. of Geneva. The Chateau de Ferney was the home of Voltaire from 1758 to 1778. His name was added to that of the town in 1878.

Fernie, town, Kootenay East District, British Columbia, Canada, on the Canadian Pacific and the Great Northern railroads; 4 miles east of Vancouver. Coal is found in the vicinity. It is an important tourist center. Pop. (1931) 2,732.

Fernkorn, ANTON DOMINIK (1813–1878), German sculptor, was born at Erfurt, Province of Saxony, Prussia. He studied in Munich under Stiglmayer and Von Schwanthaler. In 1840 he went to Vienna where he produced his first notable work, "St. George and the Dragon," which stands in the courtyard of Montenuovo Palace. In 1858 he completed a monumental work for Speyer cathedral—a series of six statues of German emperors who lay buried there. Appointed director of the Imperial bronze foundry at Vienna, he accomplished some of his best work, the most significant being the heroic equestrian statues of the Archduke Karl and Prince Eugene. Fernkorn was more important in his art for the boldness of his design than for the profundity of his conceptions.

Fernow, BERNHARD EDUARD (1851–1923), American forester, was born in Germany. He came to the United States in 1876 and took on active leadership of a movement dedicated to the preservation of U. S. forests. He was appointed chief of the Division of Forestry in 1886. His books on forestry, especially his *The Economics of Forestry,* had considerable influence on governmental techniques in the handling of national forests.

Feronia, a genus of the order Rutaceæ. The only species of importance is *F. elephantum,* an evergreen tree about 25 ft. in height, which can be grown under glass, under somewhat similar conditions to those required by the orange. It bears in summer panicles of white flowers followed by applelike fruit, the pulp of which is pleasantly edible. This fruit is known as the elephant's apple.

Ferozabad. See FIROZABAD.

Ferozepore. See FIROZPUR.

Ferrabosco, ALFONSO (fl. 1544–87), the elder, Italian musician, settled in England about the middle of the 16th century, and became popular as a writer of motets, madrigals, and virginal music.—FERRABOSCO, ALFONSO (d. 1628), presumably a son of the above, was born at Greenwich. He found favor at the court of James I, and had as a pupil the heir-apparent, Prince Henry. He wrote the music to many court masques, among others to Ben Jonson's *Volpone.*

Ferragus, FERRACUTE, FERRAGUT, FERNAGU, or VERNAGU, a giant of early French romance. Nephew of Marsilius, king of Spain, he was sent by him to defy the twelve peers of Charlemagne, whose victorious army had reached the walls of Pamplona. Ferragus overcame eleven, but Roland, the greatest, after several days' combat, killed him with the sword Durandel. Besides the French versions of the story there is an English one, *Rouland and Vernagu,* in the Auchinleck MS. of the 11th or 12th century.

Ferrand, MARIE LOUIS (1753–1808), French soldier in America, baron and count, born in France. He came to the U. S. with the French army under Rochambeau, fought as a volunteer in the Revolutionary War, and was made a member of the Society of the Cincinnati (q. v.). After his return to France he joined the expedition of Gen. Leclerc for the subjugation of Haiti in 1802, succeeding Leclerc in command after his death by yellow fever. With an army of 20,000 Dessalines, the leader of the blacks after the treacherous seizure of Toussaint l'Ouverture, besieged Ferrand in the city of Santo Domingo, but was finally driven away, and Ferrand reconquered the Spanish part of the island. In 1804, Napoleon made him captain-general of the island, which was in great part, however, in the possession of Dessalines. He proved himself a capable administrator. He abolished tithes and rents, thus reclaiming uncultivated land, and fitted out expeditions against English commerce. The Spanish governor of Puerto Rico in 1808 invaded the island and incited a revolt against French authority. With only 500 men Ferrand encountered 3,000, and was at first successful, but an attack of cavalry put his small force to utter rout, and Ferrand, rather than fall into the hands of the enemy, shot himself. See *Histoire du Comte Ferrand,* by Denis (1850) and Lacoze (1855).

Ferrar, NICHOLAS (1592–1637), English theologian, born in London, and after a busy commercial and political life, formed at Little Gidding, Huntingdonshire, a religious community (1625), the members of which taught, doctored, and nursed the villagers, practiced bookbinding, compiled harmonies of Scripture, and by the peace-

fulness of their life greatly attracted Charles I and other visitors. From 1618 to 1623 he was engaged in the business of the Virginia company, and did his utmost to prevent the revocation of its charter, but his effort failing, the company was deprived of its patent in 1623. His 'Arminian' nunnery was broken up by the Parliament (1647). See Mayor, *Nicholas Ferrar, Two Lives* (1855); *Nicholas Ferrar,* ed. by Carter (1892); J. H. Shorthouse's novel, *John Inglesant* (1902).

Ferrara, province, Italy, occupying the south half of the Po delta. It is low, in parts marshy and generally fertile. The principal products are rice, hemp, wheat, wine, salt, silk, fish and cattle. Area 1,012 sq. miles. Pop. (1936) 381,299.

Ferrara, fortified city and (since 1735) archiepiscopal see of Italy, capital of the province of Ferrara, 29 miles N.E. of Bologna, situated on the Po di Vomano, a branch channel of the main stream of the Po, which is 3 miles north. As the capital of the powerful family of Este, Ferrara was from the 14th to the 17th century a large and prosperous city. It has broad streets and possesses a fine Lombardesque cathedral (12th and 13th centuries), the castle or old ducal palace, a good picture gallery, a university (founded in 1391), a famous library, and the houses of the poets Ariosto and Guarini. The last named was born here; also Savonarola. Pop. (1936) 119,265.

Ferrara, ANDREA, an Italian whose name is found on many claymores and broadswords, but whose history is obscure. As many of these swords have been found in Scotland, it was supposed that he worked at one time in that country, but his work is equally common in the south and west of Europe. He appears to have worked in the 16th century at Belluno, also at Friuli.

Ferrari, GAUDENZIO (1484–1546), Italian painter, was a pupil of Scotto in Milan. Though his work lacks the grace of his contemporary Luini, he excels him in inventiveness and dramatic qualities. His finest frescoes are on the walls of three of the chapels of the Sacred Mountain of Varallo, and his *Crucifixion Chapel* has been described as 'the most daring among Italian works' of its kind. His paintings are also to be seen at Veroelli, Novara, Saronno, Milan, and one is in the National Gallery, London, while his *Saint George and Saint Anthony of Padua* is owned by the Historical Society of New York.

Ferrari, PAOLO (1822–89), Italian dramatist, a disciple of Goldoni. He made an early début, but only became famous after publishing *Codicillo* and *La Donna e lo Scèttico.* His best works are *Parini e la Satira* (1857), *Il Duello* (1873), *Il Suicidio* (1875), *Gli Amici rivali* (1878). Although interesting dramas, full of movement and good dialogue, they lack originality. He also wrote *Goldoni e le sue Sedici Commedie* (1852). See *Life* in Italian by his son, V. Ferrari (1899).

Ferraria is a genus of dwarf bulbous Cape plants belonging to the order Iridaceæ. The leaves are glaucous and more or less encircle the stems, surmounting which are many-flowered spathes, the stigmas of which are petaloid and fringed. The colors are curious, and though mostly dull are of great beauty.

Ferreira, ANTONIO (1528–69), Portuguese poet and dramatist, a founder of the classical school of Portuguese poetry, was born at Lisbon. His tragedy *Inez de Castro* (1587; Eng. trans. 1825) was one of the earliest tragedies in Europe after the revival of learning. The representative collection of his lyrics, etc., is entitled *Poemas Lusitanos* (1598). He also wrote *Comedia do Bristo* and *Comedia do Cioso.*

Ferrel, WILLIAM (1817–91), American meteorologist, was born in Bedford—now Fulton—co., Pa. The originality of his meteorological attainments soon attracting attention, both here and abroad, he was made assistant editor of *The Nautical Almanac* in 1857, and from 1867 to 1882 was especially appointed to the U. S. Coast Survey for tidal observation. He invented the maxima and minima tide-predicting machine, which was subsequently used by the government coast survey. From 1882–86 he was connected with the U. S. Signal Service. His works include: *Motions of Fluids and Solids Relative to the Earth's Surface* (1859); *Tidal Researches* (1874); *Meteorological Researches* (1875–81); *Popular Treatise on the Winds, Monsoons, Cyclones, etc.* (1889).

Ferrel's Law, a meteorological generalization propounded by the scientist William Ferrel, that the deflecting force exerted on the winds of the globe by the earth's rotation is inversely proportionate to the velocity of motion, increasing from zero at the equator to a maximum value at either pole. This force deflects the winds in the northern hemisphere to the right hand, and in the southern hemisphere to the left hand.

Ferrer, FRANCISCO (1859–1909), Spanish educator, was born near Barcelona. By means of a fortune left him on the death of a former pupil, he founded the 'Escuela Moderna' (modern school) at Barcelona, with branch schools throughout Spain, in which the anti-state and anti-church teachings were distasteful to the State and church authorities. In 1906 he was tried for complicity in an attempt to assassinate King Alfonso, but was acquitted. In 1909 the government accused him of instigating the riots in Barcelona, and he was tried by court martial. While admitting his radical teachings, Ferrer denied complicity in the rioting. He was declared guilty, and was shot on Oct. 13, despite protests and petitions from sympathizers in Spain and all parts of Europe.

Ferrero, GUGLIELMO (1871–), Italian historian, born near Naples. He studied law at Pisa and *belles-lettres* at Bologna. In 1896 he published *Young Europe,* a collection of social and political studies. The first volume of his celebrated work, *The Greatness and Decline of Rome,* appeared in 1902. He lectured at the Collège de France (1906), in S. American cities (1907), and in the United States (1908) at the Lowell Institute, Columbia University, and elsewhere. In 1930 he became professor of Modern History at Geneva University. He wrote *The Greatness and Decline of Rome; Between the Old World and the New; The Tragedy of Peace; Democracy in Italy; The Ruins of the Ancient Civilization; Words to the Deaf; The Third Rome; War and Peace; The Life of Cæsar.* All his Italian books were seized in 1935 by the Fascist Government.

Ferret, a domesticated albinistic variety of the polecat. It is smaller and more slender than the polecat, and is almost always of a yellowish-white color, with pink eyes. Ferrets are bred for rabbit and rat catching, and are ferocious and bloodthirsty creatures, attacking their prey behind the ear, and sucking the blood.

Warmth and cleanliness are necessary to its welfare. The hutch must be constantly disinfected. Food should consist of one meal a day, of sound bread and milk, with once or twice a week a dainty in the shape of a rabbit's liver or the head of a fowl.

The male is known as the *dog* or *hob,* and the female as the *jill.* Hobs and jills should be kept apart. The female breeds twice a year, the period of gestation being six weeks. The young are born blind, and remain so for

a month; and during this period should never be handled, as the jill, like the rabbit, will eat its young if disturbed. Experts advise the breeding of medium-sized animals, and a cross between the ferret and wild polecat gives good results in the second generation. The points of a good animal are a well-sharpened snout, lithe, muscular body, and sturdy legs.

Training should be begun at the age of three months. The handling of ferrets requires a little care; they should be lifted from immediately behind the forelegs and not by the ribs. Young ferrets should be handled daily, to accustom them to their master; they should also be taught to answer at feeding time to a particular whistle, which may later be used effectively in field work. When a ferret leaves a hole, it should be allowed to come out a little way before being taken up. The great drawback to ferrets, as hunters, is their tendency to 'lay up,' and remain in the burrow. Many people advocate muzzling or 'coping' ferrets before sending them into a burrow, while others are opposed to it. Whether to send the ferret in fed or fasting is another debated point.

Diseases of Ferrets.—Distemper, or the 'sweating sickness,' is almost unavoidable, and plays havoc with young animals; five to ten drops of castor oil should be given, with frequent washings of the eyes and nose with Condy's fluid and water. Footrot is due to dirty hutches; and the animal seems unduly liable to scab or mange: cleanliness is the best cure for both. Lice can be eradicated by insect powder, or by a mixture of powdered sulphur, sweet oil, and turpentine. Worms, which trouble ferrets greatly, are expelled by a dose of areca nut. With the exception of distemper, these diseases can be avoided by cleanliness and careful feeding.

Ferret, black-footed, a small yellowish, black-footed, ferret-like weasel (*Putorius nigripes*) of the plains of the Western United States, where it preys upon prairie-dogs, gophers, birds, and other smaller animals.

Ferricyanides are the salts of hydroferricyanic acid, $H_3Fe(CN)_6$, a crystalline needle, green-brown, solid. The principal salt is potassium ferricyanide, or red prussiate of potash, $K_3Fe(CN)_6$, a dark-red crystalline solid, formed by the action of chlorine on a solution of the ferrocyanide. It acts as an oxidizing agent, and when acted on by ferrous salts yields ferrous ferricyanide, or Turnbull's blue, $Fe_3[Fe(CN)_6]_2$. It is also used in leather, paper, and electroplating industries and as a mordant in textile dyeing and discharge in calico printing.

Ferrier, Sir David (1843–1928), Scottish physician born in Aberdeen. He became professor of forensic medicine at King's College, London, in 1872, which he left in 1889 to take the chair of neuro-pathology created especially for him—an honor to which his brilliant treatise on *Functions of the Brain* (1876) gave him the best of titles. He also wrote *Cerebral Localization* (1878–90) and *Regional Diagnosis of Cerebral Disease* (1910).

Ferrier, James Frederick (1808–64), Scottish metaphysician, was born in Edinburgh. Ferrier early became one of *Blackwood's* contributors, and to that magazine sent his 'Introduction to the Philosophy of Consciousness.' In 1842 he was appointed professor of civil history in Edinburgh University, and during one session also lectured to Sir William Hamilton's class. He then went to St. Andrew's University (1845), where he remained until his death, as professor of moral philosophy. His principal works are *Institutes of Metaphysics* (1854) and *Lectures on Greek Philosophy* (1866). See *Life* by Sir A. Grant, prefixed to the latter volume.

Ferrier, Susan Edmonstone (1782–1854), Scottish novelist, born in Edinburgh. In collaboration with Miss Clavering she began her first novel, *Marriage,* which was completed by Miss Ferrier, and appeared in 1818 anonymously, as did also her other novels, *The Inheritance* (1824) and *Destiny* (1831). These, from their clever portraiture of Scottish life, were attributed to Scott, by whom her writings were greatly admired, and of whose long friendship with her she wrote interesting *Recollections.*

Ferris, Albert Warren (1856–1937), American physician, born in Brooklyn, graduated at New York University in 1878, and at the College of Physicians and Surgeons, Columbia University, in 1882. He began to practise medicine in New York city in 1891, and was assistant in neurology at Columbia University, 1893–1901, and from 1898–1907 was assistant in the principles and practise of medicine at New York University and Bellevue Medical College. He was editor in charge of the medical department and principal contributor of the *New International Encyclopedia,* also associate editor of the *New York State Journal of Medicine.*

Ferris, Isaac (1798–1873), American clergyman, was born in New York City, and educated at Columbia, meanwhile serving in the college company stationed in the N. Y. Harbor forts during the War of 1812. He entered the Reformed Dutch ministry, and was pastor of several churches until 1836, when he became pastor of the Market Street Church in New York. In 1852 he was made chancellor of New York University, and signalized his term of office (1852–70) by devising means to lift the debt which burdened that institution. He also undertook the duties of one and sometimes two professorships. Besides many papers, etc., he published *Fifty Years' Ministry in the Reformed Church of America* (1871).

Ferrocyanides are the salts of hydroferrocyanic acid, $H_4Fe(CN)_6$, a white needle crystalline solid though the color may be blue in moist air. The prefix ferro indicates that the iron in a compound has a valence of two. Ferric, an iron with a valence of three. The most important, and the parent substance, is potassium ferrocyanide $K_4Fe(CN_6.3H_2O)$, or yellow prussiate of potash, a pale yellow solid obtained by fusing nitrogenous animal matter with potassium carbonate and scrap iron, and crystallizing the watery extract of the melt. It is not poisonous, and yields brown copper ferrocyanide with copper salts, and Prussian blue or ferri ferrocyanide, $Fe_4[Fe(CN)_6]_3$, with ferric salts. Potassium ferrocyanide is partially decomposed by dilute sulphuric acid with the evolution of hydrogen cyanide (prussic acid), but with concentrated sulphuric acid carbon monoxide is given off. Chlorine converts ferrocyanide to ferricyanide. Potassium ferrocyanide is used in the preparation of potassium cyanide and Prussian blue, in tempering steel and casehardening iron, mordant in dyeing wool and silk, process engraving and in explosives.

Ferro Islands. See Hierro.

Ferrol, city, province of Corunna, Spain, on the N. shore of deep inlet, 12½ m. N.E. of Corunna across the bay. It is a fortress and arsenal of the first class, and contains a naval school. There are manufactures of leather, naval stores, linen and hardware. Ferrol was twice attacked by the English: unsuccessfully in 1799, and successfully in 1805. It fell before the French in 1809. Pop. 30,350. Here an action was fought on July 22, 1805, between Sir Robert Calder and the allied Franco-Spanish fleet under Villeneuve, the former gaining some success.

Ferry. A franchise or right to maintain a boat upon a river or other body of water and carry people, animals, vehicles, and

other property between certain places for a reasonable toll. It is considered to be in the nature of a public highway over the water, and the franchise can only be acquired by legislative authority, either directly, as by a special act, or indirectly, through courts, municipalities, counties, commissioners, or other subordinate bodies, acting under powers conferred by the legislature. The grant by which the franchise is given usually specifies certain conditions as to time, service, etc., and whether the privilege is exclusive within certain limits or not. Either an individual or a corporation may hold this franchise, and preference is given to riparian owners, but it is not connected with ownership of land. The franchise is an incorporeal hereditament, and therefore subject to the law of real property as to descent and transfer, etc., except that in a few states the grant is considered personal, and not transferable or descendible. A ferryman is a common carrier, subject to the same duties and liabilities. The franchise may be forfeited by non-usage or by disregard of the laws creating and regulating it.

Ferry-boats.—Steam vessels are now employed for carrying passengers and vehicles for short distances across rivers, lakes, and straits. On narrow rivers these ferries are frequently worked by means of a chain lying along the bottom of the river, secured at both ends, and passing over a drum on board the ferry-boat, the drum being revolved by the engine, or in small boats, by hand. This method is particularly suitable for working in foggy weather, or where there is a strong current. Another type of ferry-boat, used on the Rhine and elsewhere, is moved across by the combined efforts of the current and the pull exerted by a long moving chain which is fixed upstream. By directing the bow upstream, the pressure of the current against the side of the boat causes it to cross from one side to the other. The large ferry-boat for passenger traffic is now usually a screw vessel having a screw at either end, it having been found that greater speed and more room could thus be obtained than with paddle wheels. These vessels are found in large numbers in N. Y. Harbor, where thousands of people are transported across the rivers every day. There are also many large paddle vessels, this type being usually selected for small or medium sized ferry-boats. Large vessels are employed for conveying railway trains in places where it is impracticable or undesirable to construct bridges. These vessels are almost exclusively paddle steamers, owing to the greater facility, which they possess for stopping and reversing when being brought into position for running the trains on board. Vessels of this type plied on Lake Baikal before the opening of the circum-Baikal section of the Trans-Siberian Railway. They are also employed at San Francisco and New York and on Lake Michigan. Rails are laid along the decks of the vessels and the cars are pushed on from a suspended bridge.

Ferry, Jules François Camille (1832–93), French statesman, born at Saint Dié (Vosges). He was called to the bar, but threw himself into journalism and commenced a series of bitter attacks on the empire and its officials, in particular upon the imperial architect and contractor, Haussmann. In 1869 Ferry secured a seat in the Corps Législatif, where he continued his opposition to the emperor, and protested against the war with Prussia. He was a member of the National Defence government (1870), and mayor of Paris. Elected to the Chamber of Deputies (1873), he distinguished himself as a vigorous opponent of clericalism. Upon becoming (1879) minister of public instruction in the Waddington cabinet, he brought in a bill directed against Jesuit instruction, which eventually accomplished the expulsion of that order from France. He became premier for the first time in 1880, and annexed Tunis. Again minister of education in 1882, he passed the law making primary education free and compulsory. He became premier for the second time in 1883, during which term he embarked upon the Tonking campaign, which occasioned the defeat (1885) of his ministry. In 1893 he became president of the Senate, and held that office at the time of his death.

Ferry, Orris Sandford (1823–75), American legislator, was born in Bethel, Conn. He was judge of probate, state senator, district attorney, and a Republican representative in Congress from 1859 to 1861, being a member of the special committee of thirty-three on the seceded states. During the war he recruited and commanded the 5th Connecticut regiment, and in March, 1862, was appointed brigadier-general, in which capacity he served until the close of the war. In 1866 he was elected U. S. senator from Connecticut, and although he opposed President Johnson's reconstruction policy, he voted against the Civil Rights Bill as hostile to the cause of education. In 1872, therefore, a coalition of Democrats and Independent Republicans re-elected him to the Senate, but he supported Grant's re-election to the presidency and his subsequent administration. He was a member of the Senate committees on public buildings and on patents.

Fersen, Fredrick Axel von, Count (1719–94), Swedish statesman, born in Stockholm; distinguished himself in the Seven Years' War against the Prussians, and was the omnipotent leader of the Hat party in the Swedish Parliament. As leader of the aristocracy, he steadily opposed Gustavus III during the Riksdags of 1778, 1786, and 1788, and was imprisoned for a few days by the king at the *coup d'état* of 1789, after which he retired into private life.

Fersen, Hans Axel von, Count (1755–1810), son of the above, served with distinction under Rochambeau in the American Revolutionary War. Gustavus III employed him as a private diplomatic agent, after the revolution, to Louis XVI and Marie Antoinette, to whom he was devoted; and it was he who planned the flight of the king and queen, which collapsed at the bridge of Varennes. Subsequently, as *chargé d'affaires* at Brussels (till 1794), he worked strenuously in favor of a league of princes against France. He lost the favor of Gustavus IV by advising moderation, and was killed by the populace of Stockholm in 1810, on the charge (unjust) of having poisoned the heir to the throne, Charles Augustus.

Fertility of Soils.—See Soil.

Fertilization.—Although many animals and plants reproduce asexually, or without accompanying sexual phenomena, the great majority, from the simplest to the most complex, reproduce sexually. The offspring arises from a composite cell, or *zygote*, to which each parent contributes one cell, or *gamete*. The male gamete, or *sperm*, unites with the female gamete or *egg* and this is *fertilization*. Then the zygote by a process of cell division, growth, and differentiation gradually develops the adult parental form. See Embryology; Sex.

Typically, sperm are tiny motile cells while eggs are relatively large passive cells stored with more or less food material for the early development of the embryo, although in some of the simplest animals and plants the gametes are structurally indistinguishable. Since the sperm

General Electric photo

STREAMLINED FERRY ON PUGET SOUND, DIESEL-POWERED

Westinghouse photo

DIESEL-ELECTRIC FERRY ON THE MISSISSIPPI RIVER

Southern Pacific photo

STEAM-POWERED FERRY ON SAN FRANCISCO BAY

usually swim actively to reach the egg, to which, in certain cases, they are attracted by chemical substances, a fluid medium is necessary and such is provided by the surroundings of the parents or, in the case of most higher animals where fertilization takes place within the oviducts of the female, by special fluids secreted for the purpose. In the highly specialized conditions in the flowering plants, *pollination* effects the transfer of pollen grains to the *stigma* of the flower where they give rise to male gametes that fertilize the eggs in the base of the *pistil*. (See POLLINATION).

In every case the essential fact is the union of the gametes which involves not merely their fusion, but the orderly arrangement of their hereditary factors, or *genes*. These form linear groups, or *chromosomes*, whose number is constant in each species. Thus each cell of the human body contains 48 chromosomes, or two complete sets of 24 each. This is reduced to one complete set during the formation, or *maturation*, of the gametes, so that each ripe sperm and each ripe egg contains 24 chromosomes, and the double, or diploid number is restored at fertilization. Thus the new individual, or zygote, receives from each parent a complete set of chromosomes, and therefore of genes, and since every cell of the body develops from the zygote, each contains two sets of genetic factors. Which genes will find expression in the new individual is one of the problems of genetics. (See HEREDITY; MENDELISM).

Since the time of Aristotle the significance of sex and sexual reproduction has aroused interest, but only within the past half century, with the discovery of the essential facts just stated, has at least a partial answer been possible. It is clear that fertilization is not reproduction. This is cell division, or the detachment of a portion of a living organism to form another, whereas fertilization is the union of two cells to form one cell, the fertilized egg. The erroneous idea that fertilization is reproduction is largely due to the fact that in higher organisms, if fertilization is to occur, it must take place at the time in the life history when the new individual is a single cell detached from the parent, that is, at the time of reproduction.

On the assumption that the primary significance of fertilization should be most evident in the relatively simple unicellular forms of life, a large amount of experimental breeding has been carried out on various species of Protozoa, in particular of Paramecium, the so-called Slipper Animalcules, which not only conjugate for fertilization at frequent intervals, but also at certain periods may undergo a nuclear reorganization process, or *endomixis*, and self fertilization, or *autogamy*. But by preventing conjugation in pedigreed cultures it has been demonstrated that these animals can live and reproduce indefinitely without conjugation.

Thus the old view that fertilization is intrinsically necessary to rejuvenate the cell and prevent so-called senile degeneration is no longer tenable. Living matter has the power to grow and reproduce indefinitely without fertilization. The same conclusion is reached from the results on the long-continued growth of the cells of higher plants and animals when isolated in tissue cultures, as well as from the indefinite propagation of many plants solely by asexual means. Furthermore, many organisms produce eggs which normally develop without fertilization, or *parthenogenetically*. In some species this is the sole method while in others it occurs periodically. In the Honey Bee females develop from fertilized eggs and males from unfertilized eggs. (See PARTHENOGENESIS).

However, when fertilization occurs, either in the Protozoa or in higher organisms, it seems clear that it has a dynamic influence; in the former having a survival value when the surroundings are unfavorable, and in the latter affording the stimulus that initiates the division of the zygote. In some cases this may be supplied by various artificial means, chemical, thermal, or mechanical, and is known as *artificial parthenogenesis*. But necessary as the dynamic factor may be, the importance of fertilization in establishing the dual nature of every sexually produced organism is beyond dispute and is the cardinal fact of heredity. It makes possible the shuffling of germinal variations since it is the pooling of the germinal changes of two lines of descent, and so multiplies manyfold the opportunities for the adaptation of the race to its environment, for descent with change—for evolution. (See EVOLUTION; HYBRID; VARIATION).

Consult L. W. Sharp, *Introduction to Cytology* (3d ed. 1934); E. B. Wilson, *The Cell in Development and Heredity* (3d ed. 1925); L. L. Woodruff, *The Foundations of Biology* (5th ed. 1936).

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Fertilizers. A fertilizer is any substance that is applied to the soil to supply food for plants. The term manure is customarily restricted to animal excrements and similar refuse of fertilizer value. The term indirect fertilizer is applied to a material that promotes the growth of plants by its effect upon the soil rather than by the supply of plant nutrients; indirect fertilizers are also known as soil amendments.

The necessity for the use of fertilizers arises from two considerations: (1) that certain chemical elements essential for plant growth—notably nitrogen (exclusive of that derived from the air by leguminous plants through the action of bacteria in their root tubercles), phosphorus and potassium—are derived almost wholly from the soil, and (2) that the quantities of these elements present in the soils in forms available for use by plants are limited and are depleted in consequence of continuous cropping, drainage, erosion and to a less extent by the decay of organic matter. The fertilizer industry has been built up around the idea of supplying these three elements to the soil in available forms. In the fertilizer trade, the phosphorus and potassium contents of fertilizers are stated to be present as phosphoric acid and potash.

Barnyard or farm manure is the mixture of animal excreta with soiled bedding and other waste that accumulates in barns or other animal enclosures. It not only supplies certain quantities of nitrogen, phosphorus and potassium, as well as of calcium, magnesium, sulphur and other plant food elements, but is also of value as a soil amendment. By supplying organic matter, it improves the tilth or physical character and the water-holding capacity, aeration and temperature relations of the soil, and favorably influences the biological activities of lower organisms that work over the stock of plant food nutrients in the soil and make them available for direct use. Also, certain organic compounds in manure stimulate plant growth in a manner analogous to the effect of hormones and vitamins on animals.

Barnyard manure varies widely in character with the quantity and quality of the feed used, the kind and age of the animals producing it, proportion of the urine conserved, the nature and quantity of litter or absorbent added and the care taken in the preservation of the manure. The quantities of nitrogen, phosphorus and potassium present in the excreta stand in direct re-

Fertilizers

lation to the same ingredients in the feeds. The richer the feeds are in fertilizing elements, therefore, the richer will be the manure produced. Thus, other things being equal, animals fed on cottonseed meal and alfalfa hay, known to be rich in fertilizing elements, particularly nitrogen, will produce much richer manure than those fed on corn and timothy hay, which are comparatively poor in nitrogen. So also liberally fed animals produce richer manure than those poorly fed.

Full grown animals, neither gaining nor losing weight nor giving milk, excrete practically all of the fertilizing elements consumed in the food, while rapidly growing animals may excrete as little as 50 per cent. Milk cows excrete from 65 to 85 per cent, and fattening or working animals from 90 to 95 per cent.

Sheep manure contains a comparatively small percentage of water and is weight for weight the richest manure produced by any farm animal, except that of poultry. Because of its dryness and loose texture it ferments readily with the development of heat and is therefore known as a hot manure.

Horse manure is also a hot manure. Like sheep manure it is dry and difficult to compact for the exclusion of air, access of which promotes fermentative heating and loss of nitrogen as ammonia.

Hog manure is very variable in composition, owing to the variable nature of the food supplied to this animal. It is generally rich in plant food, although containing a high percentage of water. It generates but little heat in decomposing.

Cow or cattle manure in general contains less plant food and more water than other farm manures. It is a cold manure, decomposing with little generation of heat.

Poultry manure is a concentrated product because the urinary secretion is semisolid and voided mixed with the feces. It may quickly lose its nitrogen, however, by fermentation if not properly stored or mixed with absorbents or preservatives.

The materials used as litter are usually poorer in fertilizing elements than the manure with which they are mixed. They, therefore, tend to dilute the manure although their use is necessary to keep stabled stock clean and comfortable and conserve values in the manure through absorption of the valuable liquids.

Leaching and improper fermentation are the chief causes of losses of fertilizer values from manure, and can best be prevented by storing the manure in compact heaps (preferably under cover or in pits with watertight bottoms) kept uniformly moist, or by spreading on the fields as fast as produced. It should always be borne in mind that the liquid portion of manure is the most valuable part and is most subject to loss by fermentation.

Ordinary farm manure, by which is meant the mixed solid and liquid excrement of various farm animals, combined with litter and more or less fermented, is naturally very variable in composition. If, however, it has received reasonable care and has not been subjected to excessive leaching and fermentation, such manure may be assumed for practical purposes to contain one-half per cent, or 10 pounds per ton, of nitrogen and potash, respectively, and one-quarter per cent, or 5 pounds per ton, of phosphoric acid.

Farm manure has a forcing effect, promoting the development of the vegetative organs of plants at the expense of the reproductive. It is therefore better suited to use on market-garden crops, grasses, and forage crops than on cereals. For root crops, such as sugar-beets and potatoes, it gives best results when applied some time before the planting of the crop. Large applications of coarse, fresh manure may prove injurious on light soils in dry seasons. In general, it is considered better to manure lightly and frequently than to apply large amounts at longer intervals of time. Farm manure is relatively deficient in phosphorus for many crops and is often used to best advantage when reinforced with a phosphatic fertilizer.

There are two general methods of applying fertilizers—broadcasting and hill or row application. The latter method has been conclusively demonstrated to be more efficient, but broadcasting by manure spreaders appears to be the only practical method with manure. Hill or row applications of commercial fertilizers are usually made through a fertilizer attachment on the planter and hence do not involve a separate operation.

Green manures are crops used for turning into the soil, whether planted for that purpose or not, and irrespective of whether they are turned under while green or after maturity. Their primary function is to add organic matter to the soil, though when legumes are used they also add the nitrogen that they have obtained from the air. A green-manure crop may also serve as a cover crop, that is, one used to cover the soil surface so as to prevent erosion, furnish shade to the ground or protect it from excessive freezing and heaving. To maintain the organic matter of the soil, bulk is of first importance and is often supplied more efficiently by a non-legume such as rye, sorghum, rape or mustard than by a legume such as clover, cow-peas, soybeans or vetch. Leguminous plants are of greatest value on a poor soil and are more beneficial to light soils than heavy ones. Green-manure and cover crops should be used when they least interfere with the regular cash crops.

In systems of farming in which much livestock is kept and concentrated, feeding-stuffs rich in fertilizing constituents are purchased and fed, the manures produced being carefully saved and used, it is possible not only to maintain but to increase the fertility of the farm; but with many systems of farming, as in grain or cotton growing, the balance of fertility can not be maintained in favor of the farm without supplementing the farm supplies of manure with commercial fertilizers, which may be fertilizer materials or mixed fertilizers.

Fertilizer materials are generally understood to be commercially obtainable individual materials that contain one or more of the three essential elements —nitrogen, phosphorus, and potassium—in such forms that plants may readily use them for their processes of growth. Such materials may be more or less pure chemical compounds of these elements with other elements or they may be complex vegetable or animal materials. The chemical compounds may be obtained from natural sources, such as Chilean sodium nitrate (nitrate of soda) or manufactured expressly for fertilizer use, such as superphosphate, or made as by-products in the manufacture of other products, such as ammonium sulphate (sulphate of ammonia) obtained in the manufacture of coke or city gas. The vegetable or animal materials may be of natural origin, like bird guano, or obtained as residues in processing plants and animals, like cottonseed meal and dried blood, or recovered from wastes, as in the case of sewage sludge. Fertilizers are classed as nitrogenous, phosphatic or potassic according to whether they contain nitrogen, phosphorus or potassium as their principal or most valuable constituent. Some may be placed in more than one of these classes. Thus potassium nitrate (nitrate of potash) is both a nitrogenous

Composition of the Principal Commercial Fertilizer Materials

Material	Nitrogen	Phosphoric acid (P_2O_5) Available	Phosphoric acid (P_2O_5) Total	Potash (K_2O)
Supplying nitrogen				
Sulphate of ammonia	19.5–21.2			
Nitrate of soda	15.4–16.5			
Calcium cyanamide [1]	21.0–23.7			
Urea	42.0–46.2			
Cal-Nitro [2]	16.0–20.5			
Calcium nitrate	13.0–15.5			
Dried blood	10.0–14.0		0.5– 5.0	
Cottonseed meal	5.3– 7.5		1.5– 2.0	2.0– 3.0
Castor pomace	4.0– 7.0		1.0– 1.5	1.0– 1.5
Process tankages [3]	6.5–10.0			
Sewage sludge, activated	4.9– 7.5	2.0– 3.6		
Garbage tankage	3.3		4.5	
Anhydrous liquid ammonia	82.2			
Ammoniating liquors [4]	37.5–44.5			
Supplying phosphorus				
Superphosphate		13.5–22.0		
Double (treble, triple superphosphate		40.0–50.0		
Precipitated phosphate		37.0–42.0		
Precipitated slag [5]		5.0–20.0		
Ground bone and bone meals	0.7–5.3		17.0–30.0	
Ground phosphate rock and other phosphatic mineral products			12.0–35.0	
Supplying potassium				
Potassium chloride (muriate of potash)				47–61.5
Potassium sulphate (sulphate of potash)				47–52
Manure salts				25–32
Sulphate of potash magnesia				26–29
Kainite				20.0–22.0
Cotton hull ashes				20.5–34.8
Tobacco stems	1.3– 1.6		3.0– 5.0	4.4– 5.4
Hardwood ashes				1.5– 8.0
Supplying nitrogen and phosphorus				
Fish scrap, dried	6.5–10.0		5.0– 8.0	
Animal tankage	5.5–10.0		5.0–18.0	
Ammo-Phos A [6]	10.4–11.7	48.0–52.6		
Ammo-Phos B [7]	15.8–16.8	20.0–22.8		
Supplying nitrogen and potassium				
Nitrate of potash	15.4–16.5			42.9–45.2
Nitrate of soda-potash [8]	13.7–15.5			13.7–16.4

[1] Usually sold under trade name 'Cyanamid.'
[2] Trade name for commercial product consisting of ammonium nitrate mixed with calcium carbonate or dolomite; a similar material is Nitrochalk.
[3] Tankages obtained by treatment of hair, feathers, leather, etc., with steam under pressure, with or without addition of sulphuric acid.
[4] Solutions consisting of ammonia and either sodium nitrate, ammonium nitrate or urea with water.
[5] The basic slag produced in this country is sold on the basis of an 8 per cent total phosphoric acid content.
[6] Trade name for commercial product consisting mainly of monoammonium phosphate.
[7] Trade name for commercial product consisting mainly of a mixture of monoammonium phosphate and ammonium sulphate.
[8] Often sold as nitrate of potash or Chilean nitrate of potash.

and a potassic fertilizer material and the ammonium phosphates are both nitrogenous and phosphatic. The composition of the more important commercial materials is shown in the table.

Nitrogenous fertilizer materials are of four classes according as the nitrogen is combined in (1) the nitrate form, (2) the ammoniacal form, (3) the amide form, and (4) the form of complex organic compounds. Examples of the classes are (1) sodium nitrate and calcium nitrate (nitrate of lime), (2) ammonium sulphate and monoammonium and diammonium phosphates, (3) urea (carbamide) and calcium cyanamide, and (4) fish scrap and cottonseed meal. The first form is considered most readily utilized by most plants and the last form least readily available to plants.

Phosphatic fertilizer materials contain phosphoric acid (P_2O_5) in different forms: (1) water-soluble, and thus most readily available, as in the ammonium phosphates and superphosphate, (2) water-insoluble but soluble in an ammonium citrate solution, as in precipitated phosphate, or (in the case of basic slag) in a 2-per cent citric acid solution, and (3) insoluble in water and the solutions just mentioned. In fertilizer analysis, water-soluble plus ammonium citrate-soluble phosphoric acid is termed 'available' phosphoric acid (in basic slag, the available is the citric acid-soluble phosphoric acid).

All commercial potassic fertilizer materials contain their potash (K_2O) in water-soluble forms that can be readily absorbed by plants. The materials most used contain potassium combined either as chloride or sulphate. The chloride is not considered as good for certain crops, especially tobacco, as the sulphate.

Mixed fertilizers are prepared by simply mixing fertilizer materials so as to obtain a product containing desired proportions of nitrogen, phosphoric acid and potash. These mixtures are for the most part made and sold by fertilizer manufacturers, though home mixing is done to a limited extent.

The grade of a fertilizer is expressed by figures that respectively show the percentages of nitrogen, available phosphoric acid and potash guaranteed to be contained, for example, 4–8–4. Grades like 4–8–4 that contain all three fertilizing elements are called complete fertilizers and constitute about 96 per cent of the mixtures sold.

Home mixing may be more economical than the purchase of factory-made mixtures. It serves as an incentive toward acquiring a knowledge of different fertilizer materials and their agricultural values, encourages experimentation to ascertain what grades are best adapted to particular soils and crops, and insures precise knowledge of the ingredients of the mixtures and the ability to duplicate any mixtures that may prove particularly desirable. Where only small quantities of fertilizers are to be used, the purchase of commercial mixtures is usually more convenient. Although scores of fertilizer materials are used in the manufacture of factory-mixed fertilizers, the farmer, whose facilities for mixing are limited, should restrict himself to the purchase and use of a few materials. All the equipment that is required is a tight floor or a wagon box, shovels, and a screen of three or four meshes to the linear inch. A wheelbarrow, scales, and a large long-handled mortar hoe for mixing are convenient accessories. Where large quantities are to be mixed a rotary mixer such as used for concrete mixing on the farm is desirable. The materials are spread in layers, preferably the most bulky first, and are thoroughly shoveled together. The mixture is then passed through the screen and any lumps present are crushed with a tamper or the back of a shovel. The stirring should then be continued until the mixture is uniform and shows no streaks of color, after which the product may be bagged and stored in a dry place until used. To avoid dampness, caking and losses of plantfood constituents, certain materials should be used only sparingly or not at all with other materials. Thus, neither wood ashes nor Cyanamid should be mixed with sulphate of ammonia, Ammo-Phos or other ammonium salts. Not more than 150 pounds of Cyanamid should be used per ton of superphosphate in mixtures. Neither quicklime nor slaked lime should be used in making fertilizer mixtures. When making mixures from high-analysis materials it is well to include at least 100 to 200 pounds per ton of the mixture of some organic material, such as peat, muck, or cottonseed meal, to serve as a conditioner, especially when the mixture is to be stored.

To use fertilizers to the best advantage it is necessary to take into account not only the character of the fertilizers themselves but also the nature of the soil and its previous cropping and manuring, the climatic conditions and the kind of crops to be grown. As a general rule fertilizers give best returns (1) on soils in good condition, that is, well tilled and abundantly supplied with humus, and (2) on high-value crops, such as market-garden crops, fruits, etc.

Crops vary in their plant food requirements. The cereals usually respond to phosphatic fertilizers and are often benefited by early applications of nitrogen. The leguminous plants—clover, peas, beans, etc.—respond well to applications of phosphates, potash and lime, especially the last two, and nitrogenous fertilizers are seldom applied since the legumes are able to acquire nitrogen partly from the air. Root and tuber crops utilize to advantage liberal applications of all the fertilizing elements in readily available forms. Fertilizers containing a large proportion of potassium are especially suited to potatoes (white and sweet) and other starch and sugar-producing roots or tubers. Orchard fruits require nitrogen more frequently than the other elements and utilize the nitrogen most readily when applied in soluble form.

In general it may be said that sandy soils are as a rule poorer in potassium than clayey soils and will therefore be more benefited by potassic fertilizers. Potassium is often extremely important on humus soils also. Soils poor in humus will be more benefited by nitrogenous fertilizers than those abundantly supplied with humus. Peaty soils may also benefit greatly from such application. Deep-rooted, slow-growing crops will often grow successfully without fertilizers on soil that must be fertilized to produce shallow-rooted, short-season crops with profit. Very soluble fertilizers should not be applied in large quantities to slow-growing crops or very long before seeding or planting.

In general farm practice it is advisable to adopt a combined system of rotation of crops and fertilization that is adapted to local conditions of soil, crop, season, etc., and to provide for as complete utilization as possible of farm manurial resources supplemented by commercial fertilizers.

Soil Amendments.—The most extensively used soil amendments are the liming materials that are added to sweeten sour soils by neutralizing their acidity. Acid soils are prevalent in humid regions. Liming materials contain calcium either as the carbonate or oxide. Calcium carbonate (carbonate of lime) is found in nature commonly as limestone and marl. Marble, chalk, coral and oyster and clam shells are other forms.

Magnesium limestone and dolomite contain both calcium carbonate and magnesium carbonate. Limestone, dolomite, etc., are ground or pulverized and sold for direct application to the soil. Calcium oxide (lime) prepared by burning limestone is known as burned lime or quicklime; when treated with water it forms slaked or hydrated lime. All give good results agriculturally. Liming materials, in addition to correcting acidity, improve the physical condition of heavy, compacted soils and stimulate the proper decomposition of organic matter.

The fertilizer materials—wood ashes, basic slag and calcium cyanamide—also serve as soil amendments in a manner similar to the liming materials.

Gypsum or landplaster, although containing calcium (as sulphate) does not neutralize sourness of soils. On the contrary, it is applied to black alkali land to destroy alkali carbonates. Benefits from the use of gypsum in many cases are due to its content of sulphur, which is utilized as a plant food.

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Fesa, town, Fars prov., Persia,

80 m. S.E. of Shiraz. It has silk, woollen, and cotton manufactures and trades in tobacco Pop. 18,000.

Fescennine verses were one of the earliest kinds of Italian poetry; they were usually dialogues of extempore verse, bandied about among the rustics at festivals, and were of a broad and licentious humor.

Fesch, JOSEPH (1763–1839), French ecclesiastic and diplomatist, born at Ajaccio in Corsica. A maternal uncle of Napoleon, he went with the Bonapartes to France, and successively became archbishop of Lyons (1802), cardinal (1803), and ambassador to Rome. On the restoration of the Bourbons (1815) he was banished from France, and retired to Rome.

Fescue Grass. See GRASSES.

Fess, in heraldry, one of the honorable ordinaries, is a band extending horizontally right across the centre of the shield, of which its width should be one-third. *Fesswise*, said of any charge placed like a fess—*i.e.* horizontally. *Parted*, or *party per fess:* when the field is equally divided horizontally into two tinctures. it is thus blazoned.

Fessenden, REGINALD A. (1866–1932), American electrician, born at Milton, Quebec Province, Canada, of New England parentage. He was head chemist in the laboratory of Thomas A. Edison in 1887–90, electrician of the Westinghouse Electrical and Manufacturing Co. in 1890 – 2, professor of physics and electrical engineering at Purdue University in 1892–3, and then professor of Electrical Engineering at the Western University of Pennsylvania until 1900, when he became special agent of the U. S. Weather Bureau.

Fessenden, THOMAS GREEN (1771 – 1837), American writer, was born at Walpole, N. H., and graduated (1796) at Dartmouth. While studying law at Rutland, Vt., he contributed several humorous poems to Joseph Dennie's Walpole *Farmer's Museum*, including his most popular piece, 'The Country Lovers,' which Mr. Lowell idealized in 'The Courtin'.' Fessenden went to London in 1801 as agent for an hydraulic machine, and lost his property in this and other ventures. While there he published a Hudibrastic poem, *Terrible Tractoration* (1803), advertising Perkins's metallic tractors, and satirizing those who declined to use them. He returned to the U. S. in 1804, edited the *Weekly Inspector* at New York for two years, and conducted various papers in Vermont until 1822, when he founded the *New England Farmer* at Boston, and was associated with this paper until his death. He published, among other books, *Original Poems* (1806), *Democracy Unveiled* (1806), and *Pills, Poetical, Political and Philosophical, Prescribed for the Purpose of Purging the Public of Piddling Philosophers, Penny Poetasters, of Paltry Politicians, and Petty Partizans, by Peter Pepperbox, Poet and Physician* (1809). See Hawthorne's *Fanshaw, and Other Pieces* (1876).

Fessenden, WILLIAM PITT (1806–69), American statesman and financier, born at Boscawen, N. H. He graduated at Bowdoin in 1823, was admitted to the bar in 1827, practised first at Bridgeton and afterward at Bangor and Portland, Me., and was conspicuously successful as a lawyer. He was a member of the lower house of the Maine legislature (1832, 1840, 1845–6, and 1853–4), was a Whig representative in Congress (1841–3), and was a member of the U. S. Senate (1854–64), first as a Whig and then as a Republican. In the Senate he was a leader of those who vigorously fought all extension of, and any concession to, slavery, to which institution he had from boyhood been opposed; and immediately after beginning his service he attracted national attention by a speech against the Kansas-Nebraska Bill. During the Civil War he ably supported the administration of President Lincoln, and as chairman of the Senate Committee on Finance rendered services of the greatest value to the national government, and efficiently aided Secretary Chase, though to his credit he opposed the Legal Tender Act. 'All that our best generals were in arms,' said Sumner, 'he was in the financial field'; and 'as a debater,' said Trumbull, 'engaged in the current business of legislation, the Senate has not had his equal in my time.' In July, 1864, after the resignation of Chase, he became Secretary of the Treasury, and served until the close of President Lincoln's first term. His position was one of peculiar difficulty, but he discharged his duties with rare judgment and ability, and, through Jay Cooke, was able to place a popular loan of $718,000,000, in the form of notes bearing interest at 7.3 per cent. and payable in three years. From March, 1865, until his death he was again a member of the U. S. Senate, and shared with Sumner and Trumbull the leadership of that body in the trying early Reconstruction Period. Besides being again the chairman of the Committee on Finance, he was chairman, also, of the important Joint Committee on Reconstruction, supplying what his most conspicuous associate, Thaddeus Stevens, the leader of the House, lacked—constructive ability of a very high order. The majority report of this Joint Committee was drawn by Fessenden, and is 'a state-paper,' says Rhodes, 'eminently concise, lucid, and sage.' Fessenden subsequently broke with his party associates by opposing the impeachment of President Johnson and voting for his acquittal.

Festiniog, vil. of Merionethshire, Wales, 8 m. E.N.E. of Portmadoc. It comprises two slate-mining villages, Llan-Festiniog and Blaenau, the larger. Pop. 9,682.

Festivals. See FEAST.

Festoon, in architecture, a decoration resembling a wreath of flowers suspended between two points. In classic architecture it is a sculptural representation of flowers and foliage used to ornament the frieze and pediment. Its use is extended to the interior of the building, where the altars and the ambry are frequently engarlanded in natural and conventional designs.

Festus, PORCIUS, succeeded Antonius Felix as procurator of Judæa in 62 A.D., and repressed with severity the malefactors who infested the province. He admitted the innocence of St. Paul when the apostle defended himself before him in that year. He died soon after his appointment.

Festus, SEXTUS POMPEIUS, a Roman lexicographer, probably of the 3d or 4th century A.D His valuable *De Verborum Significatione* is an abridgment of an earlier work by M. Verrius Flaccus, a grammarian of Augustus's time. The best edition is that of K. O. Müller (1839).

Feth Ali Shah, or BABA KHAN (1762–1834), sovereign of Persia, whose reign (1797–1834) was mostly passed in resisting Russian aggressions. See PERSIA.

Fetiales, certain Roman priests, probably twenty in number, whose business it was to watch over Rome's relations with her neighbors. If any dispute arose with another state, they had to demand satisfaction, to decide when and how war should be begun, to perform the religious rites which accompanied the declaration of war, and to preside when peace was formally ratified.

Fétis, EDOUARD FRANÇOIS LOUIS (1812–1909), Belgian writer, son of François Fétis, was born at Bouvignes, near Dinant, and appointed (1836) keeper of the Royal Library of Brussels, but devoted himself specially to the history of painters. His principal works are *Légende de St. Hubert* (1846); *Les Musiciens Belges* (1848); *Catalogue Descriptif et Historique du Musée Royal de Belgique* (5th ed. 1882).

FETISH FROM THE SUDAN REGION

FETISH FROM THE CONGO REGION

Photos courtesy University of Pennsylvania Museum.

FETISHES FROM THE CONGO COAST

The iron nails are supposed to spur on the magical action. Notice the blood stains on the head and the mirror in the body, used to close the cavity in which are held the sacramental objects that make the statue potent.

Fétis, FRANÇOIS JOSEPH (1784–1871), Belgian musical critic and composer, was born at Mons. He studied at the Conservatoire of Paris, where in 1821 he was appointed professor. His various musical compositions, embracing pianoforte and organ pieces, a comic opera (*Marie Stuart en Ecosse*, 1823), etc., are chiefly distinguished for their erudition. His chief merit lies in his *Biographie Universelle des Musiciens* (1835–44; later ed. 1874); *Histoire Générale de la Musique* (1869–76), left unfinished; *Esquisse de l'Histoire de l'Harmonie* (1840); *Traité Complet de la Théorie . . . . de l'Harmonie* (1844); *Méthode des Méthodes de Piano* (1837), etc.

Fetishism, or FETICHISM, denotes the primitive religious condition in which objects are venerated because of their oddity and their consequent supposed relationship to some particular desired end. The fetish is not a universal power; its applicability and domain is limited. The term is applicable to the state of mind which recognizes inherent virtues in charms, amulets, 'lucky' coins and the bones of saints. In W. Africa the word *ju-ju* is synonymous with fetish, and both terms have the force of 'sacred' or 'religious,' being cognate with Polynesian *tabu*. See articles JU-JU and TABU; the one book on the subject is F. Schultze's *Fetichismus* (1871); consult also Frazer's *Golden Bough* (1900), Tylor's *Primitive Culture* (4th ed. 1904), and Nassau's *Fetichism in West Africa* (1904).

Feu and **Feu-duty.** In Scotch law, a feu is in effect a sale of land in consideration of rent in perpetuity instead of a capital sum of money. Such a tenure cannot be created in England, because subinfeudation was prohibited in 1290 by the statute of *Quia Emptores*, and all land must be granted to be held, not of the grantor, but of his chief lord.

Feud, a contest by one family or tribe against another to avenge loss of life or other injury done to any of its members. It was common in the patriarchal and clan stage of civilization, where the obligation of the clan to protect itself by exacting satisfaction was not only against the offending individual, but, in default of vengeance upon him, against any member of his clan. It was practised in Europe during the middle ages and was expressly permitted by some rulers of countries until gradually superseded by arbitration and the establishment of national judicial systems. It still exists in certain places where public justice is unable to inflict adequate penalties for crime. The most notable examples in Europe are the vendetta in Corsica, Sicily, and Calabria in Southern Italy, and among the Albanians of Montenegro. It is also known in certain parts of eastern Kentucky, especially Clay county, and in West Virginia and the mountains of Tennessee.

Feudalism. The significance of feudalism in the development of politics is discussed at length under the heading POLITICS. Feudalism came into existence after the collapse of the empire of Charlemagne, and dominated the history of Europe for five centuries. The relations of feudalism were established in two ways—by the beneficium, or by commendation. By the first the king granted a tract of land to a retainer, or to some relative, on condition that he rendered military service when required. The beneficiary, in turn, allotted part of his grant to his retainers on the same condition of personal service, but the service was to himself, not to the king; and few monarchs were strong enough or wise enough to emulate William the Conqueror, who, at Salisbury, in 1086, made all holders of land swear direct fealty to himself, whatever might be their relation to some intermediate lord. By commendation the weaker submitted himself to a superior, swearing fealty to him, and holding his lands thenceforth on a military tenure.

Feudalism is seen at its best in England, at its worst in Scotland. In England, William the Conqueror, who was politically wise beyond his generation, allotted lands to his Norman knights, not in blocks, but in manors scattered all over the country, so that the beneficiaries could not easily attract to themselves the personal attachment of any great body of subjects locally united. The substitution of a money payment for military service, called scutage, gave the king a free revenue and a paid army, and it relieved the feudatories from personal service in French wars. In Scotland there never was any central authority capable of controlling the feudal beneficiaries; hence the knights rapidly acquired the position of chiefs of clans. The wars with England confirmed them in their separatist tendencies, and after the strong hand of the Bruce was removed anarchy supervened. The experience of Scotland was pretty much the experience of Germany; while France followed, though a long way after, the example of England—Louis XI. filling the rôle of William I., of Henry II., and others.

The decay of feudalism, which the growing power of the central authority rendered inevitable, was promoted largely by economic causes. With the security which feudalism itself provided agriculture flourished. Commerce followed in the train of agriculture, and industry in the train of commerce, and from barter men rose to a 'money economy.' The effects of scutage, too, were immediate and far-reaching. One of the most important was the beginning of the emancipation of English labor; for labor rents, which were the badge of servitude for the large class of villeins, were freely commuted into money payments. The introduction of money payments also made both bequest and inheritance easier. The instinct of the noble families tried to counteract this influence by a system of entails to check bequests; but nevertheless land came to be more of a commodity, and alienation a distinct possibility as well as a prospective gain. On the question of alienation the pressure of the feudal system was evaded rather than removed; and the method of evasion, in the devising of which the church lawyers played a large part, was by the creation of fictitious trusts, which were simply alienation under another name. See Stubbs's *Constitutional History* (1866); Jenks's *Law and Politics in the Middle Ages* (1898); Nicholson's *Political Economy* (1893), vol. i.; and the authorities cited *s. v.* POLITICS.

Feu de Joie is a discharge of firearms practised in the British army by way of public rejoicing or salute. Artillery fire seven guns, and then infantry commence firing, man by man, down the front rank and up the rear rank. The artillery again fire seven guns, and the infantry fire a second round. When the artillery have fired another seven guns, the infantry fire the third round, and the band plays 'God Save the King.'

Feuerbach, ANSELM VON (1829–80), German painter, the representative of modern classicism; born at Spires, and studied at Düsseldorf, Munich, Antwerp, Paris, Vienna, and Rome in 1855. His first important picture, *Hafiz at the Well*, was painted in Paris in 1852, his *Death of Pietro Aretino* at Carlsruhe in 1853, while other important works are his subjects from Dante (1857–61), which are lofty in conception and dignified in composition; also his *Iphigenia in Tauris*, and a solemn, tragic *Pieta* (1862). At Vienna he painted the powerful ceiling design, *The Titans*, in the Museum of Modelling. See *Life*, in German, by Allgeyer-Neumann (2d ed. 1904).

Feuerbach, LUDWIG ANDREAS (1804–72), German philosopher, born at Landshut, studied under

Hegel. At the age of twenty-four he became lecturer at Erlangen, but retired to Bruckberg, where he resided until 1860. His earliest work, *Gedanken über Tod und Unsterblichkeit* (anon. 1830), which explained belief in immortality as an illusion, was followed by *Abälard und Heloise* (1853), in which he contrasted the actual and the ideal with sardonic humor. Several works on the history of philosophy led up to *Das Wesen des Christenthums* (1841), translated into English by George Eliot, an attempt to reduce God, the future life, and holiness into terms of the extravagant desires of a fugitive race upon an inconsiderable planet. This was followed by several works antagonistic to religious belief, and developing a hedonistic ethical theory. 'Der Mensch,' said Feuerbach, 'ist nur was er isst' ('Man is only what he eats'). A new edition of his *Sammtliche Werke* was begun in 1903. See Grün's *Ludwig Feuerbach in seinem Briefwechsel und Nachlass dargestellt* (1874); and studies by Beyer (1872), Starcke (1885), Engels (1888), and Bolin (1891).

Feuerbach, Paul Johann Anselm von (1775–1833), German jurist, and father of the above, was born at Jena; became professor at Jena in 1801, and in the following year at Kiel. Two years later he went to Landshut; and in 1805 received a judicial appointment at Munich. In 1814 he became a president of the Court of Appeal in Bamberg, and in 1817 president of the Anspach Court. Among his works, which exercised a profound influence on German criminal law, are *Kritik des natürlichen Rechts* (1796); *Lehrbuch des gemeinen in Deutschland geltenden peinlichen Rechts* (1801); *Merkwürdige Kriminalrechtsfälle* (1808–11), a work of great psychological insight; *Betrachtungen über die Geschwornengerichte* (1813); and *Kleine Schriften vermischten Inhalts* (1833). His life was written and his works edited by his son Ludwig (1852).

Feuillet, Octave (1821–90), French novelist and playwright, born at St. Lô (La Manche), is remembered for several witty and pleasant works of fiction, including *Le Roman d'un jeune Homme pauvre* (1858), which also succeeded on the stage; *Histoire de Sybille* (1862), a mystical romance; *Monsieur de Camors* (1867); *Julia de Trécœur* (1872); *Un mariage dans le Monde* (1875); *Le journal d'une Femme* (1878); and *La Morte* (1886); and for the plays—*Dalila* (1857); *Montjoye* (1863), a satire on the manners of the second empire; *Julie* (1869); *Le Sphinx* (1874); *L'Acrobate* (1873), etc. Feuillet served his apprenticeship as literary assistant to Dumas, and was elected to the Academy in 1863. His *Théâtre complet* was published (5 vols.) in 1892–3.

Feuilleton, 'the bottom part of newspapers, generally devoted to light literature or criticism,' is a feature peculiar to the French newspaper press, though it has been adopted to some extent in Germany, and, in a still smaller degree, in England and the United States. The feuilleton was first adopted by the *Journal des Débats* in 1880. The Abbé Geoffroy is generally regarded as the father of the feuilleton. His *causeries* treated of such subjects as literature, the drama, cookery, and the fashions. A short story was occasionally substituted for the *causerie*, and ultimately the serial story became the mainstay of the popular press of France. Alexandre Dumas, Eugène Sue, and Emile Zola all practised the art of the feuilletonist.

Féval, Paul (1817–87), French novelist, born at Rennes, educated for the bar, but early took to a literary life in Paris. After many successful novels, including *Le Club des Phoques* (1841), *Mystères de Londres* (1844), *Les Amours de Paris* (1845), *Quittance de Minuit* (1846), and *Le Bossu* (1858), Féval became a convert to the Roman Catholic faith, and an active propagandist in *Les Jésuits* (1877), *Pas de Divorce* (1880), *La première Communion* (1880), etc. His *Œuvres* were printed at Paris in 38 vols. in 1895. See *Memoir* by Buet (1888).

Fever. The temperature is to some extent an index to the severity and danger of a febrile attack, but the strength of the various organs, more especially the heart, stomach, and brain, must also be taken into account, while certain fevers have special dangers peculiar to themselves. Thus in typhoid fever intestinal lesions, and in acute rheumatism cardiac lesions, constitute dangers quite apart from high temperature. From 103° to 105° is a highly febrile temperature, while over 105° is hyperpyretic. The gradual rise of typhoid distinguishes it from the rapid elevation of most other fevers.

Pneumonia, typhus, and other fevers often begin with a rigor, in which the patient shivers and complains of chill. His extremities may feel cold to the touch, and his teeth may chatter, while the thermometer reveals a temperature of 104°. A rigor occurring during the course of a fever is often accompanied by a sudden fall in the temperature and by symptoms of collapse. While the pyrexia of children is produced by comparatively trivial ailments, it is seldom attended by distinct rigors. The pulse in nearly all fevers is rapid and weak, and occasionally it exhibits a double beat. In fever the face is often flushed, and in some febrile diseases sweating is habitual, but in others the skin is hot and dry during the height of the fever, a critical sweat in certain cases marking a fall in temperature. Headache and pain in the back are common to nearly all pyrexias. The digestive functions are always impaired, sickness, nausea, and vomiting being associated with want of appetite and deranged sense of taste. Fevers, as a rule, tend to produce constipation, but some are marked by diarrhœa—*e.g.* typhoid, dysentery, and tubercular enteritis. Occasionally the pyretic state, apart from intestinal lesions, leads to diarrhœa. The tongue is a fair index to the amount of disturbance of the alimentary system. It is generally furred, often dry and cracked, or red and raw. Frequently in scarlet fever it presents a strawberry appearance, and in long-continued pyrexias it becomes brown, hard, and cracked. The urine is nearly always scanty and high-colored. The higher ranges of temperature are sometimes associated with nervous symptoms, such as delirium and convulsions, the latter being the more common in children.

The causes of the febrile state are numerous. They may be grouped thus: (1) Specific fevers, such as scarlatina, measles, smallpox, pneumonia, and typhoid; (2) constitutional conditions, such as chorea and rheumatism; (3) inflammatory affections, such as abscess, pleurisy, and bronchitis.

The diet should be fluid and should comprise only a small quantity of albuminates and a larger proportion of non-nitrogenous food. In high temperature sponging has often an extremely good effect, and cold baths, or the application of ice may be combined with the administration of antipyretic drugs and cooling drinks. For the febrile convulsions of infancy warm baths are frequently effectual. When the tongue gets dry and threatens to crack, it should be kept soft and as clean as possible.

See Electricity in Medicine.

Feverfew is a name given to various composite flowering plants, principally to *Chrysanthemum parthenium.* This is a perennial plant with evergreen, deeply-cut leaves which have a characteristic powerful perfume. In early autumn it bears numerous small white and yellow flowerheads. The scentless Mayweed,

Matricaria inodora, is often spoken of as the corn feverfew, a common annual plant with hair-like leaflets and large yellow and white flowers. The genus Parthenium is also known as 'feverfew.'

Feverwort, or HORSE GENTIAN, is a name given to certain hardy perennial plants belonging to the genus Triosteum (Caprifoliaceæ.) *T. perfoliatum* is a N. American herb about three feet in height, with opposite oval leaves, downy below; dull purplish, sessile flowers in summer, followed by orange-colored drupes which, when dried and roasted, have been used instead of coffee, and its root is an emetic and cathartic drug.

Feuillea is a genus of tropical climbing shrubs belonging to the order Cucurbitaceæ. *F. Moorei* is the one most usually grown. This is a slender, evergreen climber of considerable vigor, with long, thin, ovate leaves and pale-reddish flowers.

Fewkes, JESSE WALTER (1850), American ethnologist, was born at Newton, Mass., and graduated at Harvard in 1875. He was Massachusetts student of zoology at the University of Leipsic in 1878–80, and assistant at the Museum of Comparative Zoology at Harvard in 1881–9. He was also secretary of the Boston Society of Natural History and for a while editor of the *Journal of Ethnology and Archæology*. In 1895 he became ethnologist of the Bureau of American Ethnology. He conducted the Smithsonian Archæological expedition to Arizona. One of his most notable publications is a pamphlet on the ceremonies of the Moqui Indians.

Feydeau, ERNEST AIMÉ (1821–73), French novelist, born in Paris, wrote several able works which reflect the decadent manners of the second empire. *Fanny* (1858; Eng. trans., 1860) quickly ran to thirty editions; *Daniel* (1859), *Sylvie*, perhaps his strongest story (1861), *Le Roman d'une jeune Mariée* (1857), and the outspoken *Du Luxe des Femmes, des Mœurs, de la Littérature et de la Vertu* (1866), and several other novels, were defended by Feydeau as written in the interest of morality. This claim can hardly be allowed, but their artistic value is unquestionable.

Fez (Turkish), a brimless head covering of wool, cloth, or felt; a skull-cap, in the form of a truncated cone, ornamented with a long black tassel: the national head-dress of the Turks, generally of a dull crimson color. The name is said to be derived from Fez in Morocco, where the caps used to be manufactured.

Fez, city, Morocco, 36 m. N.E. of Mekinez, is a holy city, the chief commercial centre, and one of the capitals of the sultan. Situated on a plateau, the city is surrounded by walls. Old Fez contains the mosques, bazaars, and caravanserais, and New Fez is the official district, containing the palace, and the 'Mellah' or Jews' quarter. The most beautiful of the one hundred and thirty mosques is that of Bu Ainan; to the largest, which is also the largest in Africa, the Kairuín, is attached the Kairuín University. The sanctuary of Mulai Idris, the most holy place in Morocco, contains the tomb of the founder of the city. The chief industries are leather-work and the manufacture of colored tiles, carpets, saddlery. Raw silk, paper, weapons, drugs, and spices are also produced. In the 13th century Fez was the capital of an independent kingdom; three centuries later it was conquered and annexed by Morocco. In 1905 French, German, and British missions went to Fez to urge reforms; a 1906 conference of European powers and the U. S. at Algeciras, Spain, agreed on international police regulations. Fez was occupied by the French army of pacification in 1911, and a protectorate established. Pop. (1936) 144,424. Europeans number 9,623; natives, 134,801.

See ALGECIRAS.

Fezzan (anc. *Phazania*), country S. of Tripoli, N. Africa, a region some 450 m. by 400 m., consisting of arid plateaus alternating with low hills and valleys containing inhabited oases. Fezzan is the south portion of the Italian colony of Tripolitania, taken by Italy in 1911. Its capital is Murzuk. The population—Tuaregs, Negroes, Arabs, Moors—numbers from 50,000 to 100,000. Dates and other fruits and grain grow in abundance. It was anciently the country of the Garamantes, conquered by the Roman Balbus in 19 B.C.

Fiacre, SAINT, or FIACHRACH (?670), of noble birth, went from Ireland to France, where, at Meaux, near the modern Breuil, he founded a monastery, which acquired great reputation. His name is perpetuated in the French word *fiacre*, so called from the hackney carriages let out for hire about 1640 by the owner of the Hôtel de Saint Fiacre, Paris.

Fiala, fi-ä'la *or* fi-ā'la, ANTHONY (1869–), American Arctic explorer, was born in Jersey City, N. J. Having received a common-school education in Jersey City and Brooklyn, he was for five years assistant in a chemical and physical laboratory, then engaged for several years in photoengraving and in cartooning and designing, and for five years managed the art and engraving department of the Brooklyn *Daily Eagle*. He served in Troop C, of Brooklyn, during the war with Spain. In 1900–02 he accompanied the Baldwin-Ziegler Polar Expedition as photographer, and in 1903–05 commanded the Ziegler Polar Expedition, which made three attempts to reach the pole—two in 1904 and one in 1905. Hindered by bad ice and weather conditions, the death of all their ponies, and the loss of their ship, the expedition failed to better the earlier record of Abruzzi, but succeeded in surveying the Franz Joseph archipelago and discovered three large islands and several channels and headlands. In 1913–14 Fiala accompanied Theodore Roosevelt to Brazil. He served on the Mexican border in 1916–17, and 1918–19 was attached to the Ordnance Reserve Corps. His published works include *Troop C in Service* (1899), and *Fighting the Polar Ice* (1906).

Fibre, a stringy, thread-like structure occurring in the mineral, vegetable, and animal kingdom. Of the first, asbestos and amianthus are examples; hemp, flax, cotton, coir, and jute are among the most notable types of the second; and the fibres from the cocoon of the silkworm, the hair of goats, camels, and horses, and the wool of sheep of the third.

Fi'brin, an albuminate or proteid which occurs in muscle tissue, blood, and certain vegetable products. In blood it exists only in small quantity, 0.1 to 0.4 per cent.; but in the presence of a ferment, fibrin enzyme, which is given off by the corpuscular elements of the blood, fibrin passes from a soluble into a coagulated state, forming a spongy network in which the corpuscles lie entangled. Soon after coagulation the fibrin threads contract, so that the serum is squeezed out of the clot. Fairly pure fibrin may be obtained by beating up blood with a glass rod while coagulation is proceeding. The fibrin adheres to the rod in small, spongy masses, which coalesce. Separated thus, fibrin is a soft, colorless, stringy, and elastic material. Chemically it contains about 15 per cent. of nitrogen, the other elements being carbon, oxygen, and sulphur. Like other albuminates, it has a high food value.

Fib'ula, the bone popularly called the small bone of the leg, which supports or holds together the soft parts on the outer side of the leg below the knee. It is a long, thin bone, lying nearly parallel to the tibia or shin-bone, with which it articulates at both ends. It does not form a part of the knee-joint, but its lower end, the external malleolus, is the prominence on the outer aspect of the ankle. The external malleolus descends to a lower level than the inner, and articulates not only with the tibia, but with the astragalus. A sudden strain on the outer side of the ankle may either tear the ligaments between the bones, and produce a sprained ankle, or may snap the fibula across two or three inches from its lower end—a mishap known as Pott's fracture.

Fichte, fich'tē, IMMANUEL HERMANN VON (1797–1879), German philosopher, son of Johann Gottlieb Fichte, was born in Jena. He devoted himself to philosophical study and held professorships of philosophy at Bonn (1836) and Tübingen (1842–63). His philosophical system was eclectic, and was directed chiefly toward an orthodox 'concrete theism.' His published works include *Beiträge zur Charakteristik der neuren Philosophie; Johann Gottlieb Fichte's Leben und litterarischer Briefwechsel* (2 vols.); *Vermischte Schriften zur Philosophie, Theologie, und Ethik; System der Ethik.*

Fichte, JOHANN GOTTLIEB (1762–1814), one of the greatest of German philosophers, was born at Rammenau in Upper Lusatia. From 1784 he served as tutor to several families; but about 1790 he went to Königsberg to meet Immanuel Kant, who was greatly impressed by the *Kritik aller Offenbarung* ('Critique of all Revelation'), Fichte's earliest work, published anonymously in 1792. Following his appointment (1793) to the chair of philosophy at Jena, Fichte published three important works —*Wissenschafts-lehre* ('Doctrine of Knowledge,' 1794), *Grundlage des Naturrechts* ('Foundations of Natural Right,' 1796), and *System der Sittenlehre* ('System of Ethics,' 1798)—in which he developed his early metaphysical doctrine as an advance on the critical philosophy of Kant. A charge of atheism led to his dismissal from Jena, and he went to Berlin (1799), where he lectured without official position, coming under the influence of Schlegel and Schleiermacher. There he published his *Ueber die Bestimmung des Menschen* ('Of Man's Vocation,' 1800), in which his thought enters its later stage—that of the reconciliation of religious with first principles. He was appointed to the chair of philosophy at Erlangen in 1805, but continued, as before, his winter courses of lectures in Berlin.

Fichte's most mature work dates from this period. The treatises *Ueber das Wesen des Gelehrten* ('Of the Nature of the Scholar,' 1805), *Grundzüge des gegenwärtigen Zeitalters* ('Characteristics of the Present Epoch,' 1806), and the *Anweisung zum seligen Leben, oder Religionslehre* ('Way to the Blessed Life, or Doctrine of Religion,' 1806), are marked by high spiritual insight and fervor. Napoleon's victories in Germany roused to the utmost the philosopher's patriotism, and in his *Reden an die deutsche Nation* ('Addresses to the German Nation') he called upon his fellow-countrymen to establish German freedom upon the highest moral basis, and especially upon genuine educational reform. In 1810 he was elected rector of the University of Berlin, a post he occupied until his death in 1814.

The distinction between phenomena and things-in-themselves was a cardinal point in Kant's system. To Fichte this admission of a transcendent unknown reality seemed fatally to undermine the idealistic position, and he rejected the notion of such things-in-themselves as an inconsistency on Kant's part. Mind, or the knowing subject, cannot be thus limited from without, and yet retain its supremacy. Any limitation of mind must come from within, from the requirements of its own activity. And just in proportion as mind was regarded as itself the principle or essence of the real world, so it became necessary to show, in a more detailed and systematic way than Kant had attempted, how the nature of mind accounted for the main features of experience. In both these respects—in his rejection of Kant's dualism, and in the more systematic character of his analysis—Fichte is the forerunner of the completed idealism of Hegel. But the idealism of Fichte is usually described in contrast with that of Hegel, as 'subjective,' because in Fichte the intelligence, which is the essence of reality, is still conceived in terms which suggest the individual mind—whence, indeed, the crude misapprehension of his system as a solipsism. In his later works, as already mentioned, his philosophy assumed a more religious form of expression.

See KANT; HEGEL. Consult Adamson's *Fichte*, Everett's *Fichte's Science of Knowledge: a Critical Exposition*, Kuno Fisch-

er's *J. G. Fichte und seine Vorgänger*, and Färber's *J. G. Fichte*.

Fichtelgebirge, fich'tel-gebēr'ge, mountainous region in Northeastern Bavaria, forming a sort of central knot between the Erzgebirge, the Böhmerwald, and the Thüringerwald. It is famous for its picturesque scenery and granite quarries afford an important industry.

Ficino, fē'chē-nō, MARSILIO (1433–99), Italian physician and Platonic philosopher, was born in Florence. At the age of thirty he was appointed by Cosmo de' Medici, to the presidency of an academy for the teaching of Plato's doctrines. Ficino translated Plato's works into Latin, and published an essay, *Theologia Platonica seu de Immortalitate Animorum ac Æterna Felicitate* (1482), with the object of exhibiting Platonism as of the essence of Christian belief.

Fick, AUGUST (1833–1916), German philologist, was born in Petershagen near Minden. He became a pupil of Benfey at Göttingen and lectured there as privat-docent and, after 1876, as professor, until 1887, when he was transferred to Breslau. His chief works are *Vergleichendes Wörterbuch der Indogermanischen Sprachen* (4th ed. 1890–4); *Die griechischen Personennamen* (1874); *Die chemalgie Spracheinheit der Indogermanen Europas* (1874); *Die chemalgie Spracheinheit der Indogermanen Europas* (1875); *Die Homerische Odyssee und Illias, nach ihrer Entstehung betrachtet.*

Fiction. See NOVEL.

Fiction, LEGAL. See COMMON FORMS; PLEADING.

Fi'cus, a genus of ornamental trees and shrubs belonging to the order Moraceæ. They are characterized by the presence of monœcious flowers borne on the inside of a hollow, fleshy receptacle. The Common Fig (*F. carica*) is the species of chief economic importance (see FIG). Other widely known species are *F. elastica*, the East India Rubber Tree (see RUBBER), and the Banyan Tree (*F. benghalensis*), notable for its great spread of branches, which send down aerial roots until the single tree resembles a grove (see BANYAN TREE).

Fiddle. See VIOLIN.

Fiddler Crab. See CRAB.

Fideicommissum, fī'dē-i-komis'um, in Roman law, a trust for carrying out the wishes of deceased persons. The law with regard to wills was so technical and strict that the intentions of testators often failed. This led to the introduction of fideicommissa or trusts, by which property was left to one person with a request to transfer it to another, who was often a person who could not legally have taken a legacy. Fideicommissa were to some extent legalized in the time of Augustus, who directed the consuls to interfere in cases of hardship, and subsequently a prætor was appointed to enforce their performance. Ultimately Justinian extended all legal remedies to trusts, and provided that legacies should be construed in the same liberal spirit. Consult Sohm's *Institutes of Roman Law.*

Fidei Defensor, fī'de-i dē-fen'sor ('defender of the faith'), a title conferred by Leo X. on Henry VIII. for his book *Assertio septem Sacramentorum* (1521) against the doctrines of Luther. At the dissolution of the monasteries the Pope stripped Henry of the title, but Parliament (1544) confirmed it, and it has been used by all his successors. On the coinage it is indicated by FID. DEF.

Fidelity or Guaranty Insurance. See INSURANCE.

Fidenæ, fi-dē'nē, ancient Italian town in Sabine territory, 5 miles northeast of Rome. It was frequently at war with Rome, but was taken and destroyed in 438 B.C., though it was afterwards rebuilt. Scarcely any traces of the city now remain; the site is occupied by the Villa Spada.

Fides, fī'dēz, a goddess of ancient Rome, the personification of faith, honor, and uprightness.

Fief, fēf, a term meaning primarily cattle, and secondarily goods, but which has come to be used in a technical sense, in connection with feudalism, for the sum total of privileges conferred on a vassal or dependent. A man might easily become the feudatory or beneficiary of more than one overlord, and a confusion of obligations might arise; or an independent sovereign or lord might hold a fief from some other lord. Many of the conflicts of the feudal period arose in this way. The kings of Scotland held lands in fief in England, and for these they swore allegiance to the king of England, who usually endeavored to make the oath cover the kingdom of Scotland as well. See FEUDALISM.

Field, MAGNETIC. See MAGNETISM.

Field, CYRUS WEST (1819–92), American merchant and promoter, the seventh son of David Dudley Field, a clergyman, was born in Stockbridge, Mass. He entered the firm of A. T. Stewart & Co., New York City, when twenty years old, and a few years later engaged in the business of manufacturing and selling paper, in which enterprise he obtained a competence. Having retired from the active management of the business in 1853, after a period spent in travel, he became interested in establishing telegraphic communication across the Atlantic, his attention having been turned to this matter by his brother, Matthew D. Field, a civil engineer, who had mentioned the project of Frederick N. Gisborne, a Canadian, for erecting a telegraph line across Newfoundland for the purpose of receiving messages from fast-going steamships from Europe.

Conceiving the idea of a cable from Newfoundland to Ireland, Field busied himself with its promotion, and, interesting Peter Cooper, Marshall O. Roberts, and other capitalists, obtained a charter, in 1854, for the New York, Newfoundland, and London Telegraph Company. Three years later, soundings having meanwhile been taken by the United States and British governments, the first effort was made to lay a cable from the Irish coast at Valentia. This was a failure, through the parting of the cable, but the following year (1858), after several other unsuccessful attempts, a cable was laid, and a message from Queen Victoria to President Buchanan was conveyed on Aug. 16, 1858. Field was highly acclaimed, but on Sept. 1 the cable suddenly ceased working, and its promoter was forced into bankruptcy.

The Civil War intervening, nothing more was accomplished for several years, but on July 27, 1866, a new cable was successfully landed at Heart's Content, on the Newfoundland shore, by the steamship *Great Eastern*. Field's efforts were at last crowned with success; he was awarded a gold medal by Congress with the thanks of the nation, and other honors were showered upon him. He subsequently engaged in railroad operations and was one of the projectors of the elevated railroad in New York City. He retired from business in 1880, and in 1891 lost the greater part of his fortune in Wall Street. See ATLANTIC CABLE. Consult *Life*, by his daughter, Isabella Judson Field.

Field, DAVID DUDLEY (1805–94), distinguished American jurist, the son of David Dudley Field (1781–1867), a clergyman and historical writer, was born in Haddam, Conn. He was graduated from Williams College in 1825, was admitted to the bar in New York City in 1828, and soon gained a wide reputation as a lawyer, though it is more distinctively as a jurist that he is best known. He early saw the need of reform in both civil and criminal procedure in New York, and attracted general attention by the publica-

tion of a *Letter on the Reform of the Judiciary System* (1839), and of a pamphlet, *The Reorganization of the Judiciary* (1845). As a commissioner appointed by the New York legislature he prepared Codes of Civil and Criminal Procedure, which were adopted in that State (1848–50), and subsequently in other States, and are of great significance and importance in the history of judicial procedure in the United States. In 1857 he became the head of another commission appointed to prepare a new and complete penal, civil, and political code for New York, and did this work (completed in 1865) with thoroughness and efficiency.

An ardent advocate of arbitration, D. D. Field prepared *Draft Outlines of an International Code* (1873), which gave him a European reputation. In politics he was in turn an anti-slavery Democrat, a Republican, and again (after 1876) a Democrat; he was a member of Congress for a short time in 1877. Consult his *Speeches, Arguments, and Miscellaneous Papers* (3 vols., 1884–90), and *Life* by H. M. Field.

Field, Eugene (1850–95), American author and journalist, was born in St. Louis, Mo., the son of Roswell Martin Field, a Vermonter, who was Dred Scott's first counsel, and long a circuit judge in Missouri. His mother dying, Eugene was placed with relatives in Amherst, Mass., and received his schooling there. He travelled in Europe for several months, gaining experience as a bibliophile, and his knowledge is shown in many of his writings. He had great mechanical skill, also, in preparing copies of his own poems in the shape of ancient manuscripts, often decorated with grotesque illustrations in colors.

Returning to the United States, Field drifted from one newspaper to another in Missouri and Kansas, until called to the Chicago *Daily News* (afterward the *News Record*) in 1883. The connection with the *News* was maintained until his death, and in its *'Sharps and Flats'* column his journalistic and literary productions appeared. He satirized the crudities of Western life, and was the enemy of sham wherever he discovered it, at the same time writing some delicate and fanciful poems about children. His first publication was *The Denver Tribune Primer* (1882).

In 1887 the attention of the publishers Ticknor & Co. was called to his work by E. C. Stedman, and the same year they induced Field to collect the material of his first regular volume, *Culture's Garland*. It was followed by *A Little Book of Western Verse* (1889), *A Little Book of Profitable Tales* (1889), *With Trumpet and Drum*, poems concerning children (1892), *Second Book of Verse* (1893), *Echoes from the Sabine Farm* (with Roswell M. Field, 1893), *The Holy Cross, and Other Tales*, (1893), and *Love Songs of Childhood* (1894). *The Works of Eugene Field* contain much posthumous material. Consult S. Thompson, *Life of Eugene Field* (1927); C. H. Dennis, *Eugene Field's Creative Years* (1924).

Field, Frederick (1801–85), English divine. He edited Chrysostom's *Homilies on St. Matthew* (1839), and *On St. Paul's Epistles* (1849–62). His masterpiece, Origen's *Hexapla*, was completed after ten years' labor. He was one of the revisers of the Old Testament (1870–).

Field, Henry Martin (1822–1907), American clergyman and author, born at Stockbridge, Mass., and graduated (1838) from Williams. He bought an interest in the New York *Evangelist*, of which he became editor and proprietor. During his editorship he made many trips to foreign parts, setting down his experiences in several books of travel, including *From Egypt to Japan* (1878), *On the Desert* (1883), and *Among the Holy Hills* (1884). He also prepared lives of his brothers, David Dudley and Cyrus W. Field.

Field, John (1782–1837), British composer, was born in Dublin. He settled in St. Petersburg as Clementi's piano salesman (1802), with whom he gave concerts in Russia; and removed to Moscow (*c.* 1826), where he died. He was famous as a pianist, and his beautiful *nocturnes* profoundly influenced the works of Chopin.

Field, Kate (*c.* 1840–1896), American journalist, the daughter of Joseph M. Field, was born in St. Louis, Mo. She received her early education in Massachusetts, and afterwards studied music in Italy. She was for several years a European correspondent of the New York *Tribune* and other newspapers; and in 1874 appeared on the stage. She subsequently delivered lectures on contemporaneous subjects, and published at the national capital a weekly paper, *Kate Field's Washington* (1889–95). Some of her books are: *Planchette's Diary* (1868); *Haphazard* (1873); *Ten Days in Spain* (1875).

Field, Marshall (1835–1906), American merchant, born in Conway, Mass., and received a common school education. After serving as a clerk in a drygoods store at Pittsfield, Mass., he removed to Chicago and entered the service of Cooley, Wadsworth & Co., of which in 1860 he was, on reconstruction, admitted a junior partner. In 1865 he organized the firm which subsequently became Marshall Field & Co. Under his management it became one of the three leading mercantile houses in the world. It is estimated that his fortune, apart from his real estate holdings in Chicago and elsewhere, amounted to $150,000,000. He was noted for his benefactions to the University of Chicago, which he endowed with land and cash to the value of $400,000, and for his support of the Field Columbian Museum at Chicago, to which he bequeathed $8,000,000.

Field, Stephen Johnson (1816–99), eminent American jurist, brother of David Dudley, Cyrus West, and Henry M. Field (qq. v.). He was born at Haddam, Conn.; spent three years with his sister in Turkey; was graduated from Williams College in 1837; was admitted to the bar in 1841; and practised with success, in association with his brother David Dudley, in New York City. In 1849 he removed to California, then in the midst of the gold excitement, and there became a leader of the State bar. As a member of the first State legislature of California (1850) he did much to bring about the establishment of an efficient State judiciary system, the criminal and civil procedure of the courts being adopted after that drawn up for New York by his brother David. He was also the author of an important law providing for a system of mining regulations based closely on the customs and usages of the miners themselves in settling controversies. In 1857 he became an associate justice of the State supreme court, and in 1859 chief justice.

In 1863 President Lincoln appointed S. J. Field to the U. S. Supreme Court, in which capacity he was conspicuous for his independence, for clear thinking, for the lucid and vigorous expression of his opinions, and for his great learning. His dissenting opinions in the Legal Tender and Slaughter House cases attracted special attention. As a member of the commission appointed for the purpose (1873), he helped to revise the code of laws of California; and in 1877 was a member of the Electoral Commission, voting with the minority in favor of Tilden. In 1889 an attempt to assassinate him was made in California by former Judge Terry, who was angered by one of Field's decisions. He retired from the Supreme Court in 1897.

Field and Track Athletics. See TRACK AND FIELD ATHLETICS.

Field Army. The term field army has various meanings, especially in the United States. In the sense of a *field force* it means an army prepared to take the field, and when so engaged in campaign or in maneuvers, it is said to be in the field. (See ARMY IN THE FIELD.) In the sense of a major military organization the term signifies a large force capable of independent action and organized in all its branches for operation and administration. At times it meant a group of divisions, at others, as during the Civil War and Spanish-American Wars, a group of army corps (q. v.). Since the Act of June 3, 1916, which authorized the President to organize armies and corps in time of war, the latter has been the type of field army in the United States. When two or more field armies are organized under a commander-in-chief they are said to constitute a group of armies. On Nov. 11, 1918, the American Expeditionary Forces, under General John J. Pershing (q. v.), formed a group of armies, the First, commanded by Lieut.-Gen. Hunter Liggett, and the Second by Lieut.-Gen. Robert L. Bullard.

Under existing war plans the United States contemplates the mobilization in a major national emergency of four field armies. (See ARMY OF THE UNITED STATES.) It is planned to organize each of these armies substantially as follows: Army headquarters; three army corps; two cavalry divisions; Army special troops; Army signal troops; Army ordnance; Army artillery; a brigade of anti-aircraft artillery; Army engineer troops; Army aviation (airdrome and observation squadrons); Army medical service; and the Army trains. Tanks and chemical units will be attached, when necessary, from the General Headquarters reserve. The total strength of a field army of three corps is 344,069 officers and men.

Field Artillery is that part of the artillery of an army which accompanies the troops, and forms a part of mobile tactical units, as distinguished from the heavier calibres, which are either immobile or can move only over good roads or railroads, and which, in consequence, are kept at some distance in rear of the columns when on the march.

The World War witnessed a use of artillery of all calibres unparalleled in history; and the special conditions of trench warfare on the Western front brought about many temporary modifications in the methods of handling field artillery. There developed gradually a mixing of classes of artillery, the immobile siege and sea-coast guns with the light mobile gun of the field artillery proper, and all contributing in the common cause of blasting a way through semi-permanent fortifications for the infantry.

The German offensives of March and May, 1918, and the later campaigns in Flanders and France in 1940, all marked the return to warfare of movement and demonstrated the necessity of training field artillery to move in close support of its infantry.

Since the World War mechanical traction has increased the mobility of all types of artillery, particularly that of light field artillery, which now, drawn by trucks or fast cross-country vehicles, can follow the infantry wherever it goes, prepared to open a rapid fire on short notice.

According to its weight or calibre field artillery in the United States Army is classified as light artillery, which includes the 105-mm. howitzer and all guns and howitzers of smaller calibre; medium artillery, the 155-mm. howitzer; and heavy artillery, the 6-inch gun, the 155-mm. gun, and all cannon of calibre larger than the 155-mm. gun. It may also be classified according to its means of transport, as horse-drawn, horse, pack, or motorized artillery. Motorized artillery includes tractor-drawn, self-propelled and portée artillery. These classifications apply in general to the field artillery of all armies.

Each infantry division in the U. S. Army includes a field artillery brigade of one regiment of light artillery (75-mm. guns, horse-drawn or motor-drawn), and one regiment of medium artillery (155-mm. howitzers, tractor-drawn). In addition, the field artillery brigade includes transport for the supply of its ammunition and means of signal communications. The horse-drawn light artillery is pulled by six-horse teams, driven by three drivers who ride the left (near) horses. The cannoneers ride the carriages, dismounting and marching on foot when necessary to lighten the loads. The motor-drawn light artillery is pulled by 1½-ton trucks, which carry the cannoneers and the battery equipment. Light artillery regiments are organized into two battalions, each battalion having three gun-batteries of four guns. The light artillery directs its fire against the hostile infantry, tanks, machine gun nests, and any targets threatening its own infantry.

The medium artillery of the division is drawn by 5-ton tractors, the cannoneers riding on the tractors, the guns, and in the motor transport of the unit. The divisional medium artillery reinforces the fire of the light artillery by reaching targets beyond the range or power of the light artillery, and principally by firing on the enemy artillery. It is organized into 3 battalions, each of 2 batteries of 4 howitzers.

The medium and heavy field artillery being slow-moving, and requiring more time for their emplacement and firing, marches well to the rear of an advancing army. It does not go into action until the advance has been definitely halted by resistance that cannot be overcome by the infantry and light artillery. When it enters the battle it fires on targets beyond the range of the light artillery, placing its fire principally on enemy reserves, on roads, enemy obstacles and defenses, and upon towns and headquarters behind the enemy's front line.

Horse artillery is drawn by six-horse teams, but the cannoneers are mounted on horses and as a rule ride directly behind the guns. The U. S. type is the 75-mm. gun, the same gun as is used for the light artillery, but the weight behind the teams is reduced by omitting the ammunition from the limber chests. Horse artillery is employed to accompany cavalry.

Pack artillery uses mules as its means of transport for rough or mountainous country where wheeled vehicles cannot go, and for landing operations or as an accompanying weapon. The 2.95-inch mountain howitzer is the type weapon of the pack artillery. The howitzer is carried in 6 pack-mule loads, 5 mules each carry 8 rounds of ammunition, and one mule carries pioneer equipment.

Portée artillery is usually a part of the GHQ artillery reserve. The portée regiment is organized similarly to the 75-mm. horse-drawn artillery but the guns, ammunition and cannoneers are carried in trucks. Each battery has one light tractor, carried in a truck, for the purpose of moving the guns when the trucks cannot be used.

In a war of movement the field artillery depends for its effectiveness upon going into action quickly and on a high rate of fire. Accurate range finding in advance is usually impossible, hence the *personnel* are trained to adjust the fire of their guns to the target quickly by means of trial shots. The target is bracketed by getting a shot that strikes short and one that strikes beyond the target. The length of

75 MM. HOWITZER BEING TRAINED ON A TARGET

Photos by U. S. Army Signal Corps

75 MM. FIELD GUN IN BATTLE PRACTICE

the bracket then is reduced by systematic correction applied to the ranges as the result of observing where the shots are striking, until the exact range is found. This usually can be done in three or four shots; and as soon as the target is found, the whole battery opens a rapid fire for effect. In short bursts the 75-mm. gun can fire six rounds per minute. The heavier guns fire more slowly, and use more accurate methods in range finding and observation of fire.

Trench warfare in the World War introduced many changes in field artillery methods to meet the special conditions that existed. The great need, which brought about these changes, was for greater accuracy. In some places the front line trenches were close together, and unless the fire was accurate there was danger of causing casualties among friends. In advancing to the assault, if the infantry is to avoid heavy losses, it must keep close to the artillery barrage. This demands accuracy and skill from the artillery in order that it may not fire upon its own infantry.

For this reason every device and every method to increase accuracy of fire is employed. Maps are very accurate; an elaborate scheme of observation always is in operation; trained observers, who watch every move of the enemy and observe carefully the effect of the fire when his batteries are in action, are posted well to the front in bomb-proof and concealed stations; airplanes flying over the targets send back information of the fall of the shots; all ranges are determined carefully, and the guns are calibrated to determine their accuracy; and corrections are made for temperature of the air and powder, and for wind. Observers, batteries, battery commanders, and higher artillery commanders are connected by intricate telephone systems with each other and with the infantry which the batteries are to support. The closest touch must be maintained with the infantry, as the latter can only advance under the protection of an efficient artillery fire. In addition to the telephone, other means of communication are provided, such as radio, pyrotechnics, visual signaling and messengers, in case of a breakdown of the telephone system.

In making ready for an action involving the employment of a large amount of artillery, careful planning and preparation are necessary. The rate of fire of modern field guns is so great, and they are used in such large numbers, that it is impossible to bring up the ammunition required to keep the guns going except by accumulating a large reserve stock near the guns before the action begins. The increased mechanization and motorization of other military arms after the World War made necessary similar developments in artillery. More and more field artillery was motorized, so that it could accompany rapidly moving armored divisions and offer support to the relatively rapid advance of motorized infantry. The development of greater mobility in field artillery made it possible to utilize heavier guns for the immediate support of infantry; and in many armies 75 and 77 mm. guns were abandoned in favor of the 105 mm. howitzer, a weapon better adapted for the destruction of strong defense positions. Most heavy field artillery is drawn by tractors, but in 1938 the German army developed a 10-inch gun and a 210 mm. howitzer drawn by combination tractor-trucks, capable of making 30 m.p.h. on a smooth-surface road. The gun was transported in five sections and could be prepared for action in from one to two hours. It had a range of from 17 to 36 miles. So important is mobility for all types of field artillery, that in practically all armies guns too heavy for rapid transport have been abandoned or designed for use on railway carriages only.

In the war which began in 1939, field artillery demonstrated its importance in the advance, in spite of the prominent part played by attack bombing planes. Objectives far removed from the main body of the German army were reduced by bombing attack, as well as points chosen for sudden penetration. The bulk of the Nazi advance, however, was prepared by rapid artillery fire, delivered by guns which were sufficiently mobile to follow infantry and motorized units closely, as they advanced into territory held by the enemy.

See ARMY; ARMY OF THE UNITED STATES; ARTILLERY; BLITZKRIEG; CAVALRY; GUNS; WORLD WAR, THE SECOND.

Field Beet. See MANGEL-WURZEL.

Field Cooking, or the preparation of army rations in the field, in the U. S. Army is in the immediate charge of the mess sergeant, who, under the direction of the company commander, draws or purchases all rations and other supplies for the mess, prepares the bills of fare, and is responsible for the care of rations and kitchen equipment and for conduct at meals. The actual cooking is done by one or more specially trained army cooks who are selected by the company commander and who are under the supervision of the mess sergeant.

Where transportation facilities are good, ranges and other kitchen equipment for supplying food for large numbers may be carried into camp and on the march. Two types of field ranges are furnished by the quartermaster's department, suitable for feeding 150 and 55 men respectively. They are rectangular, boxlike structures of sheet iron, similar to the Dutch oven, and when properly set up over a trench may be used for roasting, baking, broiling, frying, and stewing. Fireless cookers and rolling kitchens or soup wagons are also provided. Consult *The Army Cook* (U. S. War Dept., 1928).

Field Cricket. See CRICKETS.

Field Equipment, Military, includes all articles issued to the soldier for personal use, when on active duty. Such articles include his individual equipment and the additional unit equipment that the soldier carries to perform his duties in the field. The articles vary somewhat according to the branch of the service and the nature of the soldier's field duty.

The individual equipment of the American rifleman includes rifle with sling; bayonet and scabbard; cartridge belt of heavy webbing, with suspenders for carrying haversack and metal eyelets for attaching canteen in its cloth cover; first aid packet and pouch; and pistol holster (if his duties require that weapon). In the haversack, worn when he does not carry a blanket, he carries extra underwear and stockings, toilet articles and the few small things he may wish to have with him. On the outside of the haversack he carries his mess equipment, consisting of meat can, a deep metal dish with a flat cover that may be used as a plate, and knife, fork and spoon. The cup fits over the bottom of the canteen and is carried on the cartridge belt. Rolled, and attached to the haversack is an overcoat, or raincoat, and secured to the coat the soldier's extra shoes, also his trench helmet.

Each combat branch of the army takes into the field additional articles of equipment necessary to the fulfilment of its mission. The special field equipment for infantry includes an infinite variety of items. The full field equipment of the U. S. infantry rifleman weighs 51 pounds. The French infantryman carries 66 pounds, the German 33.6, the Japanese 50.5, and the English 55. (See KIT.)

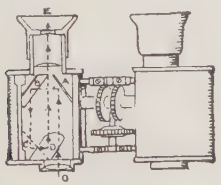
Fieldfare (*Turdus pilaris*), a species of thrush, common in Great Britain as a winter visitor. It is a native of Northern Europe, but migrates south in winter as far as the Mediterranean. It is abundant in Norway, and, contrary to the ordinary habit of thrushes, is social in its nest building, numerous nests being often seen on one spruce tree. The fieldfare is about the size of a blackbird, but has longer wings. The head, neck, and some other parts are grayish; the tail is black, with a white line on the outer feathers; the general upper surface is chestnut brown; the under surface is white, with a reddish-yellow breast streaked and spotted with black.

Field Glass, an optical instrument for viewing distant objects, composed essentially of two telescopes reduced in size. Field glasses are of two kinds—the Galilean type, and the prismatic combination. The latter comprises

Galilean or Ordinary Field Glass.

AB, object; OO, object lens; CD, eye-piece (concave); EF, virtual image.

binoculars in the form of double-eyed telescopes, monoculars or single-eyed pieces, and the special binoculars used by field naturalists. The last noted have extending arms which place the object glasses above the head, and they also permit of the object lenses being placed at any angle. The Galilean or ordinary field glass consists of a convex object lens, and a concave lens forming an eye-piece. It was greatly improved upon by Porro, an Italian engineer, who discovered that by using a combination of prisms he was able to dispense with the usual reversing lenses in a telescope. Owing to the great absorption of light, however, prisms



Prismatic Field Glass.

The rays from the object, O, are reflected by the prism at A and B, and again at C and D, to the eye at E.

could not be used for field glasses until a suitable medium was found in the prisms of colorless boro-silicate Jena glass.

The prismatic binoculars of today are made in four different powers, the one magnifying three diameters now taking the place of the opera glass for the theatre; the glasses magnifying six and nine diameters taking the place of the Galilean type for general use; while binoculars with a power of twelve diameters, but not taking in such a large field of view, are of special service to the naturalist and the military and naval officer.

See TELESCOPE; MICROSCOPE.

Field Guns. See GUNS.

Field Hospital, an army hospital including tents, stretchers, and other equipment, capable of being transported from place to place in the zone of military operations. It occupies a position midway between the field dressing stations, from which the patients are brought to it by stretcher bearers or by ambulance, and the evacuation hospital, with which it has communication by motor ambulance. In the U. S. Army three field hospitals, each equipped with about 200 beds, are provided for a division. See HOSPITALS.

Fielding, HENRY (1707–54), English novelist, born at Sharpham Park, near Glastonbury, Somersetshire. He rapidly produced a series of plays, which, though favorably received, achieved no lasting reputation. The first of these, *Love in Several Masques*, was produced at Drury Lane (1728), being followed, among others, by the satirical plays, *The Author's Farce* and *Tom Thumb* (1730). Two versions of Molière's, *The Mock Doctor* (1732) and *The Miser* (1733), also met with success. The *Historical Register for the Year 1736*, produced by Fielding at the Haymarket, probably led, owing to its satire on Walpole, to the passing of the Licensing Act of 1737, establishing the censorship of the stage.

Fielding's first novel, *Joseph Andrews*, begun as a parody upon *Pamela*, but worked out on independent lines, appeared in 1742. Three volumes of *Miscellanies* (1743) included *A Journey from This World to the Next*, and *The History of Mr. Jonathan Wild the Great. The History of Tom Jones*, published in 1749, is Fielding's most celebrated novel. To a more careful workmanship is added a riper experience, both of life and literature, than appears in his earlier work. *Amelia* (1751), Fielding's last novel, is somewhat less powerful than *Tom Jones*. The *Covent Garden Journal*, founded by Fielding in 1752, ran for only a short time. Signs of his careful study of subjects connected with his magisterial duties appear in his *Enquiry into the Increase of Robbers* (1751). In June, 1754, illness drove him to Lisbon, where he died in October. In his *Journal of a Voyage to Lisbon* (posthumous, 1755), he tells with characteristic courage the story of this journey.

Fielding rebelled against the cramped, conventional morality of Richardson (q.v.), which spelt mere virtuous respectability, and drew a broader, more human picture of life. His style is as vigorous as his thought, while his humor never fails, even when, as in writing *Jonathan Wild*, he was in the midst of family and financial troubles. The first collected edition of his works was published in 1762; another edition in 10 vols. by W. E. Henley appeared in 1904; while the *Miscellanies and Poems*, edited by J. P. Browne, appeared in 1872. Consult essay on Fielding by A. Murphy, prefixed to *Works* (1762); the *Lives* by F. Lawrence and by Austin Dobson are the most complete. There are also short *Lives* by Sir W. Scott, Roscoe, and G. M. Godden (1909).

Fielding, WILLIAM STEVENS (1848–1929), Canadian public official, was born in Halifax, N. S., and educated in the public schools. He entered the field of journalism, joining the staff of the Halifax *Morning Chronicle*, with which he was associated for twenty years (1864–84). He entered politics in 1882 as member of the provincial legislature, and from 1884 to 1896 was premier of Nova Scotia. In 1896 he was elected to the Dominion Parliament, and in the same year was appointed Minister of Finance in the Cabinet of Sir Wilfrid Laurier, a position that he retained until 1911.

He framed the tariff law of 1897, including the provision for a preferential tariff on British goods; introduced the surtax on German goods in retaliation for adverse tariff action by Germany, later repealed; and provided for a special 'dumping' duty upon goods introduced into Canada at unfairly low prices (see CANADA, *Tariff*). He was a representative at the Conference of Colonial Premiers in London in 1902; delegate to the Imperial Conference in 1907; and one of the plenipotentiaries who negotiated the Franco-Canadian commercial treaties of 1907. He also negotiated commercial arrangements with the United States, Italy, and Belgium (1909–10), and with Japan (1911), and in 1911 was one of the Canadian commissioners who negotiated the reciprocity agreement passed by the U. S. Congress but lost in Canada with the defeat of the Liberal Party (see RECIPROCITY). He was a member of the Privy Council of Canada.

Field Madder (*Sherardia arvensis*), a naturalized weed

(*Rubiaceæ*) with pointed leaves arranged in whorls, and little umbels of tiny pinkish flowers.

Field-marshal, formerly a general officer who ranked just under the commanding general. Now in British and European armies the term designates an officer of the highest rank, except that of commander-in-chief.

Field Museum of Natural History, founded by and named after Marshall Field, a Chicago merchant, his gifts and bequests amounting to over $9,000,000. It is situated in Grant Park, Chicago, and is divided into four departments: anthropology, botany, geology, and zoology. It has a working library of about 50,000 titles, an exchange system, departmental laboratories, an herbarium, study collections of many thousand specimens, etc., and is under the administrative control of a board of trustees. Its executive is the director, who is assisted by four head curators.

Field Officer. A military term applied to all officers above the rank of captain and below that of general. The division is this: *line* officers are all up to and including the grade of captain; *field* officers, to include the grade of colonel, and *general* officers all above the grade of colonel. See OFFICERS, MILITARY.

Field of the Cloth of Gold, the name given to the meeting between Henry VIII. and Francis I. of France, in June, 1529, near Calais, and was so called because of the magnificence and splendor of the proceedings. Wolsey took a prominent part in the negotiations, which led to a treaty between Henry and Francis.

Fields, ANNIE ADAMS (1834–1915), American author, was born in Boston, Mass., the daughter of Dr. Z. B. Adams of that city. She was educated at the school of George B. Emerson in Boston, and was married to James T. Fields in 1854. Thereafter she lived in Boston and Manchester - by - the - Sea, Mass. maintaining a notable salon in Boston for many years. She published *Under the Olive,* verse (1880), *The Singing Shepherd, and Other Poems* (1895), *Authors and Friends* (1896), *A Shelf of Old Books* (1896), *Orpheus: A Masque* (1900), and biographies of Whittier, Hawthorne, Mrs. H. B. Stowe, Warner, and James T. Fields.

Fields, JAMES THOMAS (1817–81), American publisher, author, and lecturer, was born in Portsmouth, N. H. He received a high-school education and entered the bookstore of Carter & Hendee at Boston when fourteen years old. In 1845 he became a partner in the firm of Ticknor, Reed & Fields, which in 1854 assumed the well-known name of Ticknor & Fields, acquiring as authors on its list Emerson, Hawthorne, Longfellow, Whittier, Holmes, and many other eminent authors, of whom Mr. Fields was an intimate friend and counsellor. In 1861 he succeeded Lowell as editor of *The Atlantic Monthly;* he retired from this position and the firm on Jan. 1, 1871, resuming his literary work. His books were *Poems* (1849), *A Few Verses for a Few Friends* (1858) *Yesterdays with Authors* (1871), *Hawthorne* (1876), *In and Out of Doors with Charles Dickens* (1876), *Underbrush* (1877), and *Ballads and Other Verses* (1880). His *Yesterdays with Authors* has perhaps been more used for extra-illustrating purposes by collectors than any other American book published. See *Memoir,* by his wife (1881).

Field-works. See FORTIFICATION.

Fieri Facias. Under the common law practice, a writ directed to the sheriff, commanding him to seize sufficient of the goods and chattels of a judgment debtor named therein, to satisfy the judgment. Originally the personal property of the debtor was considered bound by the issuance of the writ, but later under the Statute of Frauds the writ was held not binding as to innocent purchasers until execution by the sheriff. It is generally held that a sheriff is not authorized to break into a dwelling house to seize goods under a *fieri facias,* or *fi. fa.* as it is commonly known, but if he has effected a lawful entrance he may force open inner doors in his search. He may force his way into buildings not used as dwellings. At common law, only personal property can be taken under a *fieri facias,* and if there is not sufficient personality, and the debtor owns real estate, the latter may be sold under another process known as a *venditioni exponas.* In many states the writ of *fieri facias* has been superseded by execution, which is broader in its scope and extends to real property also, and may be directed against the person in certain cases. See CAPIAS AD SATISFACIENDUM; EXECUTION; VENDITIONI EXPONAS.

Fieschi, or FIESCO, GIOVANNI LUIGI, COUNT OF LAVAGNA (1523–47), a young noble of Genoa, who formed a plot to overthrow Andrea Doria, the real ruler of Genoa. He seized the town and arsenal on the night of Jan. 2, 1547. Andrea took to flight, but Fieschi, in the moment of triumph, accidentally fell into the harbor and was drowned. See Callegari's *La Congiura del Fieschi* (1892), and Schiller's play. Also Sismondi's *History of the Italian Republics* (Eng. trans. 1870).

Fieschi, GIUSEPPE or JOSEPH MARIE (1790–1836), conspirator, born at Murato, in Corsica, was an ex-soldier and convict, who (1835) having contrived an infernal machine—twenty-four gun-barrels set in a frame—fired it from a house in the Boulevard du Temple as Louis Philippe of France was passing in a military review, but the king escaped with a scratch. Fieschi and his accomplices were executed Feb. 19, 1836. See Du Camp's *L'Attentat Fieschi* (1877).

Fiesole, tn. and episc. see of Italy, prov. Florence, 3 m. N.E. of Florence, has ancient Etruscan and Roman remains, an 11th-century cathedral, and some fine late mediæval monasteries, in one of which Fra Angelico lived for some time. The people are engaged in straw-plaiting. Its ancient name was Fæsulæ; it originally belonged to the Etruscans, and in Roman times was more important than Florence. Pop. about 2,000.

Fiesole, GIOVANNI. See ANGELICO, GIOVANNI.

Fife, a musical instrument belonging to the flute family, and seldom having more than one key. The compass of the fife is about two octaves, and as the scale is diatonic, only airs of simple melodic structure can be played upon the instrument. Fife and drum are much used for military music. See FLAGEOLET, FLUTE, PICCOLO.

Fife, chief station of the African Lakes Corporation, on the Stevenson Road, British Central Africa, about 80 m. W. of the head of Lake Nyasa. It is ultimately to be connected with the Rhodesia railways by way of the Broken Hill district, Kalomo, and the Victoria Falls.

Fife, ALEXANDER WILLIAM GEORGE DUFF, DUKE OF (1849–1912), son-in-law of King Edward and Queen Alexandra, married their eldest daughter, Princess Louise Victoria Alexandra Dagmar (born Feb. 20, 1867), at Buckingham Palace, on July 27, 1889. The duke, who was born in 1849, sat in the House of Commons as Liberal member for Elgin and Nairn from 1874 till 1879. He succeeded to the title of Earl of Fife in 1879, and was created Duke in 1889. He had two daughters, Lady Alexandra Duff, born in 1891 (heir, by special remainder), and Lady Maud Duff (1893).

Fifeshire, a maritime co. of E. Scotland, bounded on the N. by the Firth of Tay, S. by the Firth of Forth. Area, 504 sq. m. Pop. (1938) 283,600. The county town is Cupar. The county is a succession of undulating hills and small valleys. The highest hills

are the East (1,471 ft.) and West (1,713 ft.) Lomonds. A large area of blown sand extends N. from St. Andrews to the Firth of Tay. The minerals include coal (extensively mined), ironstone, limestone, freestone, and shale. For centuries Fife has taken a leading place in the development of agriculture. The manufactures include linen at Dunfermline and floorcloth at Kirkcaldy. Iron-founding, machine-making, shipbuilding, brewing, distilling, brick and tile making, coarse linen and sailcloth manufacture, shipping and fishing are largely carried on. St. Andrews is the 'Mecca' of golf, and almost every coast town has its links. The antiquities include remains of Roman military stations near Carnock and Loch Orr, and of several hill forts; monastic buildings at St. Andrews, Dunfermline, and on the island of Inchcolm; Falkland Palace (former royal residence), and St. Andrews Castle. See Sibbald's *Hist. of Fife and Kinross* (1710); Mackay's *Hist. of Fife and Kinross,* 'County Hist. of Scot.' (1896); Conolly's *Fifiana* (1869); Millar's *Fife, Pictorial and Historical* (1895).

Fifth Column, a term designating the traitorous element. During the Spanish Civil War General Quiepo de Llano is said to have remarked: "Outside the gates of Madrid four columns of our troops are engaged. But within there is a fifth column which, at the proper time, will arise and overthrow the defenders."

Fifty-four Forty or Fight, a popular cry in the U. S. between 1842 and 1846, and especially during the presidential campaign of 1844, used as an aggressive, jingoistic assertion of the claim of the U. S. to latitude 54° 40′ as the north-west boundary. See North-west Boundary Dispute.

Fig, any tree or shrub of the genus Ficus, the most important of the Moraceæ, widely distributed in warm countries. The pipul or bo-tree (*F. religiosa*) and the banyan (*F. indica*) are venerated by the Brahmans. *F. elastica,* the indiarubber plant, and some others yield caoutchouc; and though their milky sap is acrid, that of *F. saussureana,* one of the cow-trees, is creamy and nutritious. Many have edible fruit, but by far the most important is that of the common fig (*F. carica*), a tree introduced into Europe from the East in early times. It is cultivated in California, where it was introduced by the missions, and produces large crops, and occasionally in the eastern U. S., particularly in the Carolinas. In California fig-culture has been stimulated by the introduction of a special insect which produces pollination of the flowers of the various species. Green (*i.e.* undried) figs are esteemed as dessert fruit; and large quantities of dried figs are exported from the Mediterranean districts, those from Smyrna being considered the best. The fruit is the product of a peculiar inflorescence. The female flowers are crowded near the peduncle, with the male flowers above them. These are enclosed by the succulent floral axis, except at the apex. Fertilization is said to be effected by means of a chalcid fly (*Blastophaga grossorum*). A good recent account of the process, called 'caprification,' is in the *Cambridge Nat. His.* (v. 347–9). See bulletins on 'The Fig' by Cal. Board of Horticulture (1890) and U. S. Dept. of Agriculture (1901)

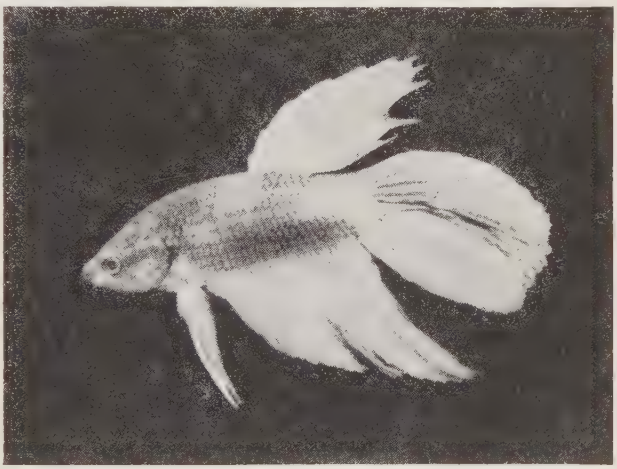
Figaro, a comic character introduced upon the stage by Beaumarchais in 1775, and appearing in the *Mariage de Figaro Barbier de Séville,* and *Mère Coupable.* Though sharing some characteristics with figures well known in Italian comedy, Figaro was yet a novel character, and achieved a wide popularity. The *Mariage de Figaro* was utilized by Mozart as the basis of an opera.

Figaro, Le, one of the most widely circulated of all French newspapers. It was published and suppressed several times before Villemessant, in 1754, resuscitated it as a weekly. In 1865 it appeared as a daily paper. After the fall of Napoleon III. in 1871 the *Figaro* became a pronouncedly political journal, and attacked the Republican government with great violence. Villemessant died in 1879, and the editorship then passed to a triumvirate, of whom François Magnard was chief. Twice a week a literary supplement is issued, and an *Illustrated Figaro* is published every month.

Fighting-fish, a name given to *Betta pugnax,* a bony fish of the family Labyrinthidæ, found in the streams of Siam, on account of its pugnacious habits. The fish is bred by the Siamese, who hold fish-fights, similar to cock-fights.

Figline, tn., Tuscany, Italy, on l. bk. of Arno, 15 m. S.E. of Florence, has manufactures of straw-plait and cutlery. Pop. 11,478.

Fig-shells (*Pyrula*) are tropical gasteropods with elongated pear-shaped shells, with a short spire and a long canal. The foot is broad and truncated in front. the mantle lobed, the lobes being reflected over the shell, and nearly meeting above. A species (*Pyrula canaliculata*) is common along the north-eastern shore of the United States, where it is known as conch or winkle, and is very destructive to oysters. From its interior stem, or 'column,' the Indians formerly made their inferior, or white, wampum.



Courtesy The Shedd Aquarium

FIGHTING-FISH

Figueras, city, Catalonia, Spain, 20 m. N.E. of Gerona on the railway to French frontier (26 m.). It is an ancient frontier fortress, and has textile and other manufactures. Pop. 10,714.

Figueras, y Moracas, Estanislao (1819–82), Spanish politician, born at Barcelona; became one of the orators and leaders of the Republican party.

Figueroa, Francisco de (1540–1620), Spanish poet, born at Alcalá de Henares, was an Italianate follower of Boscan and Garcilaso de la Vega. His poems, mostly pastoral and amatory, were highly prized by his contemporaries.

Figuier, Guillaume Louis

(1819–94), a popular French scientific writer, born at Montpellier, was appointed professor at the school of pharmacy of Montpellier (1846), being transferred to a like position in Paris (1853). Here he was editor of *L'Année Scientifique et Industrielle* (1856). Some of the most popular of his works have appeared in English translations, as *The Ocean World, The World before the Deluge, The Day after Death, the Vegetable World, Reptiles and Birds*, etc.

Figurate Numbers, in mathematics a series of numbers which may or do represent some geometrical figure, in relation to which they are always considered as triangular, pyramidal, hexagonal, etc., numbers. The general term of each series is

$$\frac{n(n+1)(n+2)\ldots(n+m)}{1.2.3.4.\ldots.(m+1)},$$

in which m determines the nature of the series, and the successive integral values of n determine the corresponding terms of the series.

Figwort.
1, Flower, section; 2, fruit.

Figurate series are divided into orders. When $m = 0$, the series is of the first order; when $m = 1$, the series is of the second order; when $m = 2$, the series is of the third order; and so on. The figurate series of the first order is the series of the natural numbers, 1, 2, 3, 4, 5 . . . . . n. The figurate series of the second order has for its general term $\frac{n(n+1)}{1.2}$, and the several terms are deduced from this by making in succession $n = 1, 2, 3, 4$, etc. The resulting series is 1, 3, 6, 10, 15, 21 . . . . . $\frac{n(n+1)}{1.2}$, etc. The numbers of this series are called triangular numbers, because they express the number of points which may be arranged in triangles, thus—

.
. .
. . .
. . . .
. . . . . etc.

The series of square numbers is 1, 4, 9, 16, 25, 36, 49, etc. The series of pentagonal numbers is 1, 5, 12, 22, 35, 51, etc.; and of hexagonal numbers, 1, 6, 15, 28, 45, 66, etc.

Figurehead, SHIP'S, a bust or full-length figure placed over the cut-water of a ship immediately under the bowsprit. Great expense was formerly lavished on their decoration; a master carver superintended the embellishment of stern and prow. The figurehead of the *Sovereign of the Seas* in 1637 represented King Edgar trampling on seven kings. Those ponderous figures were discontinued in the British navy by order of the Admiralty in 1796. A number of the older frigates in the U. S. navy had handsomely carved figureheads in which the name of the vessel suggested some allegorical treatment. Thus, the heads of an Indian and a Macedonian warrior at the bows of the *Delaware* and *Macedonian* indicated the practice observed in the early days of the navy. An interesting example of an old figurehead or beakhead is that of the *Half Moon*, the first ship to sail up the Hudson River, in 1609, commanded by Henry Hudson.

Figurehead of the Half Moon.

Figwort, a name given to various members of the genus Scrophularia, the characteristic features of which are a five-lobed calyx, a nearly globose corolla, the upper lip of which is two-lobed and the lower three-lobed, and a capsule opening with two valves, the edges of which are turned in. *S. Marylandica*, with greenish-purple flowers, a tall, rank herb, is found in woods.

Fiji, a group of islands in the South Pacific Ocean, from 200 to 250 in all, between 15° and 22° S. lat., and 177° E. and 178° W. long., about 1,100 miles N. of New Zealand; total area, including Rotuma (between 12° and 15° S. lat., and 175° and 180° E. long.), 7,083 sq. m. About 80 of the islands are inhabited; the largest are Viti Levu (4,053 sq. m.) and Vanua Levu (2,130 sq. m.). The islands are of volcanic origin, the more important rise abruptly from the shore to a height sometimes exceeding 4,000 ft. On the windward or S.E. side, the islands are clothed with dense forest and jungle; on the lee side is grass land, more lightly timbered. The climate is equable and remarkably healthy for Europeans; the average temperature in the shade in the cool season is 72°, rising to 84° in the hot season, extremes lying be-

Courtesy Mason Warner

FIJIAN NATIVES IN CEREMONIAL COSTUME

Courtesy Mason Warner

FIJIAN WAR-CLUB DANCE

tween 60° and 96°. There is rain all the year; the driest period is from April to October. Acacias, casuarinas, etc., impart an Australian character to the vegetation. The chief products are bread-fruit, bananas, plantains, peanuts, yams and dalo (taro), coconuts, sugarcane, rice, maize and cotton. The principal exports are sugar, copra, bananas, trocas shell, molasses, maize, fresh fruit and vegetables, and bêche-de-mer. Fiji is British and is administered by a governor appointed by the crown, assisted by an executive council of 7 members. The capital is Suva (pop. 15,522) in the island of Viti Levu. A few generations ago the Fijians were notorious cannibals, and human sacrifices formed part of most of their ceremonies. Pop. (1936) 198,379 (97,574 Fijians, 85,002 Indians, 4,028 Europeans, 4,574 of European and native descent, and some Polynesians and others).

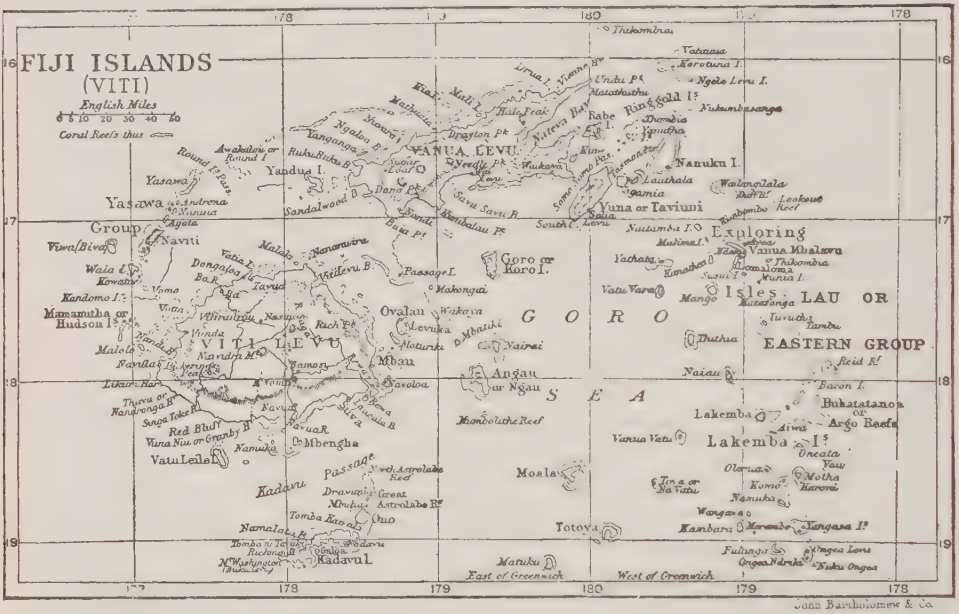
Discovered by Tasman (1643) the islands were ceded by the chiefs and people to Great Britain in 1874. Rotuma was added to the colony in 1880. See Calvert and Williams, *Fiji and the Fijians;* G. C. Henderson, *The Discovery of the Fiji Islands* (1933); N. Walker, *Fiji: Their People, History and Commerce* (1937).

Filariasis, the general term applied to several disorders, believed to be due to the presence in the human body of certain nematodes. The filaria whose life history is best understood at present, and which is most definitely associated with those lymphatic diseases, is *Filaria Bancrofti,* with its embryo. *Filaria Bancrofti* is a slender, spiral, snakelike form, infesting human lymphatics in tropical and semitropical countries. The creature is viviparous, and the embryos, which attain a size of 300 micromillimeters, find their way through the lymphatics of their host to the thoracic duct, and thence into the blood, where they are found only at night (hence *nocturnal*). Its usual nocturnal habit is an adaptation for its access to its intermediate host, which is a mosquito generally of the variety known as *Culex ciliaris.* With each meal of blood from a filarial subject the mosquito sucks many embryos, which bore their way into its tissues and there grow. Concerning the further development there are at present two theories. The earlier theory is that the embryos infest the mosquito until its death. Should the mosquito then fall or be blown into drinking water, the filaria may, either free or still in the body of its intermediate host, be swallowed by its definitive host, man. The more recent theory is that the filaria re-enters its human host from the proboscis of the mosquito while the latter feeds. When any form of filariasis does arise, it seems to be due to a blocking of lymphatics, either by the adult or by the embryo. Hence arise chyluria, elephantiasis, lymphangitis, and other lymphatic diseases, described under their respective headings. Filariasis occurs in the southern part of the United States, South America, Spain, Africa, Australia and the islands of the Indian Ocean. Prevention of filariasis consists in eradication of mosquitoes and careful screening. Various methods of treatment have been attempted including injection of antistreptococcic and antiplague sera, likewise antityphoid vaccine, excision, local injection of sulpharsphenamine and ethyl chloride sprays. If the glands of the groin are involved excision is contraindicated.

Filaria sanguinis hominis perstans, also found on the west coast of Africa, has not yet been traced to its intermediate host. For a time it was looked upon as the probable cause of 'sleeping sickness,' but its occurrence in the blood of patients suffering from that disease is now known to be merely accidental.

Consult C. C. Bass, *Filariasis, in Blumer's Bedside Diagnosis* (1928); Sir P. Manson, *Tropical Diseases* (1929); E. R. Stitt, *Diagnostics and Treatment of Tropical Diseases* (1929); E. H. Starling, *Principles of Human Physiology* (1933); R. P. Strong, *Onchocerciasis, with Special Reference to Central American Form of Disease* (Harvard Press, 1934).

Filberts (*Corylus*) are distin-



John Bartholomew & Co.

guished from hazel-nuts by the prolongation of the husk beyond the point of the nut within. They can be grown successfully on almost any soil. The trees should be so managed that at the age of a hundred years they should

Filberts.
1. Section of fruit; 2, nut.

be 15 or 20 ft. across the top, but not higher than 5½ ft. from the ground. The male or catkin blossoms are produced most freely at the upper part of the trees, and should be allowed to remain long enough to fertilize the pistillate or female flowers, which are produced on the smaller boughs. When the weather is very still and warm, it is well to tap the boughs with a stick, to make the pollen fly.

Fildes, Samuel Luke (1844–1927), English artist, born at Liverpool, in 1866 entered the Academy schools in London. When in 1869 the *Graphic* was started, Mr. Fildes contributed to the first number a sketch entitled 'Casuals.' He became acquainted with Millais, and afterwards with Charles Dickens, who engaged him to illustrate *Edwin Drood.* After having illustrated books and magazines for several years, he applied himself to painting. His first picture was hung on the line at the Academy in 1872, and was entitled *Fair, Quiet, and Sweet Rest.* In 1874 he exhibited *A Casual Ward,* in 1876 *The Widower,* in 1879 *The Return of the Penitent,* and *The Doctor* in 1892. This last picture, by which he is chiefly known, is now in the Tate Gallery. Made A.R.A. (1879), R.A. (1887). His state portrait of King Edward VII was exhibited at the Academy in 1902.

File, a steel implement used for smoothing rough surfaces by abrasion. It is usually fitted into a wooden handle for ease in manipulation, the portion which enters the wood being known as the 'tang.' Its working surface is covered by a series of more or less parallel ridges which are produced by the cuts of a chisel. These ridges are inclined at an angle of about 55° to the long axis of the file. The file is said to be 'single-cut' or 'float' if a single series of parallel ridges covers its surface; 'double-cut' if these are crossed oblique by a second and finer set. Most tools at present made are of the second kind, and are further classified according to the relative fineness of their teeth. The ordinary grades are known as 'rough cut,' 'middle cut,' 'bastard,' 'second cut,' 'smooth,' and 'superfine,' or 'dead smooth.' 'Single-cut' files are used for working brass and copper, 'double-cut' for iron and steel. They are manufactured in various shapes and sizes, but all are (in section) some simple modification of the square, triangle, or circle. Rasps, which are employed for working wood, horn, etc., have their surface covered with a number of detached teeth, which are cut with a triangular punch instead of a chisel.

Files are invariably made of steel, and after being cut and hardened are considerably improved by exposure to the sharpening action of a sand-blast. Much of the cutting is still done by hand, a certain advantageous irregularity in the cuts being thus obtained which is difficult of reproduction in a machine, but in order to make files with economy and rapidity file-cutting machinery is generally employed, especially in the United States.

File-fish, a member of the genus *Monacanthus* of tropical and semi-tropical bony fishes. These fish have the dorsal fin supported by three spines. The first spine is very strong, is roughened like a file, and is locked to the second so that the two can only be raised simultaneously. The body is covered with small, rough scales so that the skin can be used for polishing, while eight strong teeth are present in both jaws. The diet consists of hard-shelled molluscs and corals. Certain species occur on the southerly coast of the United States, and the *Alutera Schoepffi* or 'barnacle eater' is found as far north as the New England coast. The file-fish in many respects resembles the well-known trigger fish.

Filibuster, a term of doubtful origin, which (in the French form *flibustier* and the Spanish form *filibustero*) was used in the 17th century almost synonymously with buccaneer (see Buccaneers), but which in the 19th century came to be applied to any one who in disregard of international law invades or attempts to overturn the government of a foreign state. Specifically, the term is generally applied to those citizens of or residents in the United States who, during the 19th century, organized or joined expeditions fitted out in the United States for the purpose of gaining possession of the governments of Spanish-American countries or of aiding those countries to gain independence from Spain. Aaron Burr and his followers planned what was essentially a filibustering expedition against Mexico, and the citizens of the United States who helped to secure the independence of Texas were essentially filibusters. (See Burr, Aaron, and Texas.) The most famous filibusters, however, were Narciso Lopez, who in 1850–1 led two expeditions from the United States to Cuba, and William Walker, who led an expedition into the Mexican State of Sonora (1853) and an expedition into Nicaragua in 1855. (See Lopez, Narciso; and Walker, William.) The *Virginius* expedition of 1873 was really a filibustering enterprise. (See Virginius Affair.) Later the term came to be applied, in American politics, to legislators, especially in congress, who delay or prevent the passage of a bill by resorting to irregular methods of opposition. See J. J. Roche, *By-Ways of War; the Story of the Filibusters.*

Filicaja, Vincenzo da (1642–1707), Italian poet, of noble Florentine family, won his first laurels by a series of stirring odes on the victory of Sobieski over the Turks in 1683. His fame rests upon a few beautiful lyrics, such as the sonnet, *Italia, Italia, o tu cui feo la sorte.* A new edition of his *Poesie e Lettere* appeared in 1864. See Caponi's *Vita di Filicaja* (1901).

Filigree, a kind of metal lace, which requires few and primitive appliances for its manufacture, so that the earliest examples of jewelry are generally thus constructed. The ancient Greeks were especially famous for their beautiful filigree work. Central Asia has always been celebrated for the work; in Europe, Malta has produced it so largely that it is known as Maltese work; Norwegian specimens, however, are much superior. Ireland produced good work of this class in the 10th and 11th centuries. Medieval Venice was renowned in this connection, and Benvenuto Cellini describes the manufacture. Filigree is generally made of unalloyed silver, melted and drawn out in wire which is beaten flat, tightly twisted, and again beaten, thus acquiring a serrated edge. The wire is then woven into patterns, and soldered at the points of junction. See B. Cuzner, *A Silversmith's Manual*; G. E. Gee, *Goldsmith's Handbook* (1937).

Fillan, fil'an, St. (d. 777?), Irish missionary to Scotland in the eighth century. He labored chiefly at Strathfillan, Perthshire, where he founded a monastery, afterward restored by Robert Bruce. The *coygerach*, or crozier-head, of the Saint, now preserved in the Antiquarian Museum at Edinburgh, is of wrought bronze, in a casing of silver gilt. His feast day is Jan. 9.

Fil'let. (1.) A narrow ribbon for binding the hair. (2.) In architecture, a small, square, flat section in the mouldings of a cornice or between the flutes of a column (see Column). (3.) A charge in Heraldry (see Heraldry).

Fill'more, Millard (1800–74), the thirteenth President of the United States, was born of English stock at what is now Summer Hill, Cayuga county, New York, on Feb. 7, 1800. He was reared on a farm, where he received little systematic education, but early devoted himself assiduously to reading. At the age of fourteen he was bound apprentice to a clothier and wool carder; and during the five years he labored at this occupation he used the means at his disposal to cultivate his mind. In 1819 he began the study of law, receiving his board in return for his work in the office of a country lawyer; and during part of this time he also taught school, until in 1823 he was admitted to the Buffalo bar. He practised at Aurora, N. Y. (1823–30), and afterward at Buffalo, where he built up a reputation for sound legal knowledge and sterling probity.

In 1828 Fillmore began his political career, being in that year returned by Erie county to the State legislature as a member of the Anti-Masonic Party, and was largely instrumental in procuring the abolition of imprisonment for debt in New York. During the period 1832–42 he was four times elected a Member of Congress, where he was chairman of the important Committee of Ways and Means (1841–3), from which he reported the tariff bill of 1842. He was conspicuous for his industry and for his anti-slavery views, strongly supporting John Quincy Adams in his fight for the right of anti-slavery petition. In 1844 he was the Whig candidate for governor of New York, but was defeated by his Democratic opponent, Silas Wright. In 1847 he was elected controller of the State, serving from Jan. 1, 1848, to Jan. 1, 1849. In 1848 he was elected Vice-President of the United States on the Whig ticket with Zachary Taylor, and during the debates in the Senate over the Compromise Measures of 1850 (q. v.) he proved an admirable presiding officer.

On the unexpected death of President Taylor (July 9, 1850), Fillmore became President, serving until March, 1853. Upon his accession to office the success of the Compromise Measures was assured, and these measures, when passed, promptly received his signature. He proved an able statesman, and his Presidency was marked by the passing of many salutary measures, notwithstanding that his party was in the minority. During his administration diplomatic relations with Japan were established. His signing of and attempts to enforce the Fugitive Slave Act (see Fugitive Slave Laws) rendered him unpopular in the North, however, and he failed to secure a renomination in 1852. (For an account of his administration, see United States, *History*.)

In 1856 Fillmore was nominated for the Presidency by the American or Know-Nothing Party, and was endorsed by the Whig Party; but the struggle lay between the Republican and Democratic candidates, and he received only the 8 electoral votes of Maryland. In 1855 and again in 1866 he visited Europe. He took no active part in the Civil War, although he gave his influence to the cause of the Union. After his retirement from political life he resided at Buffalo, where he died on March 8, 1874. Consult Chamberlain's *Biography;* also, Griffis'; *Stoddard's Millard Fillmore;* Wilson's *Presidents of the U. S.*

Film. See Capillarity.

Film, in photography, a flexible sheet of celluloid or like material upon which is spread a thin, sensitized coating for the making of pictures; a similar sheet bearing the completed picture; also the sensitized coating of photographic plates. The flexible film was invented in 1887 by the Rev. Hannibal Goodwin of Newark, N. J., whose patent rights in the invention were upheld, after prolonged litigation, by the U. S. Circuit Court of Appeals (March 9, 1914). Films are manufactured in rollable ribbon form, or in cut sheets for use in plate holders or special containers. Their chief application is in amateur photography and the production of moving pictures. See Photography; Cinematograph; Moving Pictures.

Fil'mer, Sir Robert (*c.* 1589–1653), English political writer, was born in Kent. He was an active royalist during the Civil War, and suffered greatly during the Commonwealth. His fame rests on the *Patriarcha* (first printed 1681), an argument for the patriarchal origin of government, the fallacy of which was later exposed by Locke. Filmer assumed the most extreme form of the doctrine of the *jus divinum* —'the right divine of kings to govern wrong.' See Divine Right.

Filmy Ferns (*Hymenophyllaceæ*), an order of ferns, including more than two hundred species, which grow in large, spreading, mossy masses on rocks and tree stems in moist places. They are chiefly tropical, rare in the Southern Hemisphere, still rarer in the Northern. They are remarkable for the minute structure of their sporangia, and for the exceptionally simple structure of their moss-like leaves, which consist usually of only a single layer of uniform parenchymatous cells. See Fern.

Filters and Filtration. In its broadest sense, filtration is the process of the separation from liquids or gases of the foreign matters in suspension, and is usually accomplished by passing the liquid or gas through porous media known as filters, the interstices of which are too small to admit passage of the solid matter or whose material is such that the suspended particles are absorbed thereby or attracted thereto.

The filtering layer may consist of loose detached particles, such as sand or charcoal, or compacted bodies, such as porous tiles or porcelain biscuit, or of woven or felt material, such as cloth (wire or textile), flexible glass wool or paper. The liquid may pass through the filter solely by gravity or its passage may be accelerated by the use of pressure or vacuum.

The simplest type of filter is that commonly employed in the chemical laboratory, consisting of a circular sheet of washed and unsized paper, folded twice and fitted into a funnel. For strongly alkaline and acid liquids which act on paper, tubes or special funnels compacted with glass wool, asbestos or the like are used.

One of the most important applications of filtration is in connection with the purification of large water supplies (q. v.). Another is in the improvement of water for domestic and other small uses. For this purpose, gravity filters operated at slow rates and pressure filters at higher ones, both employing sand, bone charcoal, activated carbon, spongy iron, excelsior and many other materials, have been used. Also in service are pressure filters equipped with cylinders of unglazed porcelain (Pasteur filters) or diatomaceous earth. In addition, there are filters with

removable fiber disks, useful for refining the appearance of drinking water, beverages, foods, medicines, and a variety of chemical preparations.

Slow sand filters and those of unglazed porcelain are efficient for the removal of bacteria, although the latter must be cleaned and sterilized frequently to prevent the growth of organisms through the filter medium. Rapid filters are efficient for improving the appearance, although previous chemical treatment is often necessary with them, as in the larger municipal plants. Filters, even rapid ones, filled with charcoal, particularly the variety called activated carbon, are effective for the removal of odor, color and taste, although the filter material, like any other absorbent, is subject to the law of diminishing returns and must be regenerated or replaced after a period of use.

As in their municipal exemplifications, slow filters are cleaned by raking or scraping their surfaces; rapid filters are cleaned by washing the filter material using the reverse currents of water.

Industrial Filtration.—In addition to those mentioned above, various types of filters are employed in the industries. Bag filters of horse hair, cotton or wool, coarse or fine, are employed for mucilaginous or oily liquids, often to prepare them for disk or similar fine filters.

The plate-and-frame filter press is used extensively for handling large volumes of liquids especially where it is required to collect the removed suspended matter. This press consists of a series of solid vertical plates with hollow frames between, mounted on two parallel horizontal bars and clamped together by means of a jack at the lower end of the press which forces the carefully jointed plates and frames against the head or inlet end of the press. A filter cloth is laid over each plate to cover both faces and a frame is set on each side of it so that a series of filter cells is formed between the plates. Liquids are introduced through the head of the press into each cell and the filtrate escapes through the filter cloths and passages in the plates to a collecting trough alongside the press, leaving the suspended matter in the form of a cake. This latter may be washed in place or it may be discarded by opening the press and dropping it.

Other pressure filters, called shell filters, consist of a group of cloth-covered frames inserted in surrounding tanks or shells, in which a pressure against the filter cloth on the hollow frames may be maintained. These filters are cleaned by opening the shell, removing the frames and scraping off the accumulations on the cloth.

Vacuum filters are a more recent invention. The first one, the Moore filter, consisted of a perforated frame over which a bag was fastened. This filter unit was then immersed into liquid to be filtered and a vacuum applied. When dirty, the unit was withdrawn from the liquid and cleaned.

Of more recent application are the continuous vacuum filters, like the Dorrco, Oliver, American, Streamline, Feinc and others. These usually consist of revolving hollow drums or disks partially immersed in the liquid and so arranged that the part of the revolving filtering surface immersed in the liquid is under a vacuum. This condition continues as the cloth with its accumulation of suspended matter emerges, and partial drying of the filter cake is effected. The vacuum is then changed to pressure and the cake is removed by blowing and scraping. The cleaned cloth then enters the liquid for another cycle.

The plate and frame press is best for varnishes, pigments and for syrups or other solutions with small percentages of solids. The shell type is best for removing bleaching clay from mineral oils. The vacuum filter has the widest application and is especially well fitted for removing minerals, paper fiber, cane fiber and crystals.

Sewage Filtration.—Sewage filtration is really sewage oxidation, the filters, usually operated intermittently, being devices for subjecting the organic matter in the sewage to the action of the oxidizing and nitrifying bacteria while at the same time supplying the necessary oxygen to the bacteria from the air (see SEWAGE AND SEWAGE DISPOSAL).

Sewage sludge is a product of all sewage treatment works. Sometimes this is digested and partially dried on vacuum filters of the type used in industry.

Air Filtration.—While screens and filters for air have found wide use in industry, and the property of textile fibers to remove dust from the air and the efficiency of activated carbon as an absorbent for gases, particularly as used in gas masks, are well known, the spread of air conditioning in public buildings, restaurants, shops and houses has markedly increased the use of these filters.

Samples of Pittsburgh dust, analyzed by the American Air Filter Company, had the following composition:

Soot	44	to 48	%
Siliceous matter	40	to 45	%
Coal dust	2.5	to 3.5	%
Fibrous matter	3	to 5	%
Miscellaneous	5	to 8	%

Where the less efficient air washing is not in use, the filters usually consist of fixed units—sometimes in the form of endless belts. Straining and contact are depended upon for the removal of suspended matter. Where straining is depended upon, the units may consist of layers of steel wool, glass wool or cotton or other textile fibers. The filter media in these units are replaced when dirty. Where contact is depended upon, the units usually consist of a series of intricate passages, a mass of hollow tubes, or even a layer of steel wool or fiber coated with a viscous substance which catches the dust. In some of the filters, this coating, with its included dust, is removed continuously; in others, intermittently. Often the coating is cleaned and re-used.

Ultra Filtration is the term applied by physical chemists to the removal of particles below the limit of ordinary microscopic vision (about one-tenth of a micron) which can be seen only by the ultra microscope but which may be filtered out by means of parchment, collodion and similar membranes.

See also WATER WORKS.

Consult *Chemical Engineers' Handbook;* Catalogues of the International Filter Co., the Roberts Filter Mfg. Co., and others; *Data Book on Air Conditioning* of the American Society of Heating and Ventilating Engineers.

ROBERT S. WESTON,
Consulting Engineer.

Fim'bria, GAIUS FLAVIUS, an ally of Marius and Cinna in the civil war against Sulla. In 86 B.C. he was sent to Asia as legate to Valerius Flaccus, whom he persuaded the soldiers to murder. Sulla attacked him in 84; and as his soldiers deserted him, he committed suicide at Pergamum.

Fim'briate in biology means fringed; in heraldry it refers to a narrow border running round a bearing.

Fin. See FINS.

Finale, fē-nä'lā, the name given to that part of a musical composition which finishes the act of an opera; also to the last movement of an instrumental composition. The instrumental finale varies greatly in form, from the lively rondos of Haydn to the gigantic vocal finale, in variation form, of Beethoven's Ninth Symphony. The operatic finale, as usually understood, is a concerted piece, sometimes extending to a considerable number of different movements, for one, two, or

more single voices, with or without chorus. The best type is to be found in Mozart's operas. In Wagner's works there are no finales separable from the preceding parts of the acts; each act is a continuous whole.

Finale nell' Emilia, nel-lā-mēl'yä, town, Emilia, Italy, on the River Panaro; 15 miles west of Ferrara. It has manufactures of silk and other fabrics, and cattle trade. Pop. about 13,000.

Finance, Personal. Personal finance originated in Germany more than a century ago; to-day it is found in some form or other in practically every civilized country. The need and demand for personal finance have arisen in the United States only within recent years. Like all other large industries, personal finance had to go through its pioneering stage, and thus followed much the same history as commercial banking.

In 1790 there were only three State banks in the entire country: those of North America (Philadelphia, 1781), the Bank of New York (1784) and the Massachusetts Bank. The first Federal Bank was opened in Philadelphia in 1791. By 1811 there were 88 State banks, and these with their operators were held in low esteem by the public; they were denounced on all sides. Ten colonies were quite content to get along without banks, simply because they had never had any. In short, bankers were looked upon very much as, to-day, we look upon fake stock promoters and bucket-shop owners.

Public agitation forced both the first two United States banks out of business. From that time until the Federal Reserve system in 1914, there were no central banks. Whereas a century ago commercial banking was considered a menace to prosperity, there are now billions of dollars invested in the business and the banker occupies a most enviable position. This change has been brought about by public experience and accumulated knowledge. See BANKING.

The urgent need for a personal finance service for the working classes grew out of the outrageous usurious rates of interest extorted by 'loan sharks.' While legally a lender could not charge more than 6 per cent per year, the lowest rate charged was 10 per cent *monthly.* In Kansas City investigation revealed interest at 15 per cent monthly; in Philadelphia, 20 per cent; Pittsburgh, 72 per cent to 300 per cent per year; Chattanooga, 200 to 300 per cent per year; Indianapolis, as high as 1500 per cent, and New Orleans from 600 to 1700 per cent per year.

As a result of such evil conditions, from time to time in different communities, little groups of earnest and sincere persons would wage an 'anti-loan shark campaign.' Though well-meaning, these good people knew little or nothing about the business nor the circumstances under which these illegal operations were conducted. Hence these individual efforts were doomed to failure and the loan shark continued to flourish.

In 1908 the first organized, scientific effort was made to combat the evil. The Russell Sage Foundation took the matter in hand, carried out a nation-wide investigation, and in 1916 drafted legislation for the small loan business, a measure entitled the *Uniform Small Loan Law.* The proposal was submitted to the legislatures of several States and, as was expected, met with considerable opposition.

Before making public its proposed *Uniform Small Loan Law,* the Russell Sage Foundation had been co-operating with the New Jersey Legislature with the result that, in 1914, that State had framed and passed such a law—the first to do so. At that time New Jersey had a population of 3,187,767, about 3 per cent of the nation's total. By the time twenty-five States had adopted the *Uniform Small Loan Law* they embraced a population of 66,000,000—some 55 per cent of the entire population of the United States.

The success of mass production is contingent upon mass financing, which in not many recent years has grown up in America. With the large centers of population attracting great numbers from the rural sections, and with a rising standard of living, there is an increasing demand for facilities which can be furnished only by personal finance companies.

This new method of finance now allows to the average man without tangible assets the advantages of credit which in the past were extended exclusively to the propertied few. Of the persons one meets in the streets, 85 per cent cannot go to a commercial bank and borrow money. Formerly, the only means at their disposal of surviving family or business crises was to ask favors of friends or patronize the loan sharks. Now, however, a total estimated at $2,600,000,000 a year is being advanced in small loans to American wage earners and persons of moderate means who do not possess the usual collateral.

The huge total in small loans is augmented by indirect loans on the purchases of goods—instalment credit—which amounts to about four billion dollars a year. It has been proved sound economics to give needed credit to the masses, for unless the nation's purchasing power is maintained, industry will lag. It is estimated that one family out of every two in the industrial centers now obtains a small loan every year, while instalment buying is well-nigh universal.

The economic viewpoint does not alone sanction credit for the masses. Educated public opinion recognizes the broader, humane and social usefulness of financing the working man and woman, for them to obtain the essential services of life—medical care, education, recreation and other tangible adjuncts to healthy living. On being asked what was the best collateral, Mr. J. P. Morgan replied, 'character.' It is generally admitted that a person engaged in the business of running a home and family must and should be able to borrow on occasions, just like the manager of any other business, to consolidate his debts, to meet unexpected emergencies, or to finance some improvement that will establish him on a firmer financial basis. Consumption needs financing no less than production.

Consumer credit has now taken its place as an essential of up-to-date business. Curiously enough, this expansion of mass finance facilities was not carried out by the banks themselves but by a crop of organizations of a new order. These new agencies have made their presence felt; the capital invested has raised them to equality with some of the greatest American industrial groups—such as the iron and steel and lumber industries.

Ten groups of agencies now carry on the business of financing the nation's consumers. The first group includes all the firms in the instalment field; the other nine are the different types of small loan concerns: unlicensed lenders, personal finance, commercial banks, remedial loan societies, employers' loan funds, pawnbrokers, co-maker loan companies, credit unions and axias (Jewish societies). From the ranks of smaller operators several enormous chains have grown. Now mergers and holding companies weld some of these concerns into even larger operating units. Two personal finance companies alone lend out more than $100,000,000 a year in loans of $300 or less in 350 cities.

The average American workingman has proved himself as good a credit risk as the man of property. This fact emerges

Finance, Public

from the experience of all these operators, dealing with persons usually having no tangible security other than their home furniture, and who never saw the inside of a bank. Almost all the agencies of mass credit show losses of less than one per cent of their volume of loans. This extremely low rate of losses on loans would seem to indicate that the average man and woman have strengthened their economic positions by the use of them.

The older of the Personal Finance companies looked to the public for their initial capital. Encouraged by the success of the movement, reputable banking houses welcomed the opportunity to become actively engaged in it, and thus enabled personal finance to swing into the front rank of big business.

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Finance, Public, is the science which deals with the receipts and expenditures of government. It is a branch of the science of economics and yet differs in several fundamental respects from the study of the economics of the private individual. Both economics and public finance deal with problems of value and the relationships among individuals in the matter of wealth, but the chief objective of private economy is the accumulation of wealth whereas that of public economy is the promotion of the general welfare. While ordinary economic writings treat of the material relations of individuals to each other, public finance treats of material relations between individuals and the State. Some of the important subjects with which fiscal scientists deal are the general character of the public economy; the relative merits of prices, fees, and taxes in obtaining revenue for the State; the extension of the State into fields hitherto reserved to private enterprises; the administration of the budget; the relative merits of giving government services for a profit, at cost price, or gratuitously; the nature and principles of public debt; and all the problems incident to the subject of taxation such as the use of taxes for social control or for revenue, the merits of the various tax systems, the problem of double taxation, and the difficulty of achieving a co-ordinated tax system, especially in the United States with its numbers of different sovereign entities (Federal, State, and local governments).

According to Edwin R. A. Seligman there are basic differences between the public group, or state, and any private group, such as a corporation, which must be considered in the science of public finance. There is first the fundamental character of the purposes underlying the State—the preservation of law and order. The State is a universal and compulsory group, unlike the private group. One cannot evade or resign from the State. There is not the reciprocity found in private transactions where payment is in terms of benefits received. Nor can the benefits from public transactions be very accurately weighed and measured. Finally, the State economy is considered as being a perpetual thing which outruns the life of any private corporation.

The history of the science of public finance is one of an increasingly complex subject. In the ancient and medieval States governmental operations were comparatively simple, and expenditures were met by the personal revenues of the sovereign, or by gifts or fees for justice and protection, or by forced tribute. No body of formulated principles of finance was required; nor did such exist until early modern times. When the newly discovered lands began to produce wealth in vast quantities in the sixteenth and seventeenth centuries, the mercantilist governments of Europe obtained much of their income through the distribution of trading privileges and the customs on imports. Adam Smith was one of the first writers to condemn the incurring of excessive debts by governments, and he advocated limiting the sphere of State activity and consequently of State fiscal activity to defense, justice, education, and highways. The views of Smith's *Wealth of Nations* influenced most economists to his point of view in the period following him. Especially in Prussia and Germany, during and after the eighteenth century, was there developed a combined system of finance, political economy, and political science under the name of *Cameralwissenschaft.*

However, widespread changes took place during the nineteenth and twentieth centuries in the nature of governmental activities and the methods of financing State expenditures. Instead of general concern over governmental deficits at the end of a fiscal year, one group of economists after the fiscal disasters of the 1929 depression advocated a policy of alternate periods of governmental surpluses and deficiencies, the first to be accumulated during years of business prosperity and the second to be incurred during depressions by purchasing goods on the market in order to stimulate business enterprise and raise the price levels Also, various devices were applied to adjust the public finances in times of fluctuating currencies and monetary standards through a manipulation of bond markets, foreign trade and exchange, and conversion of bond issues. The results of expert knowledge in the field of public finance were shown in the success with which the German Minister of Economics, Hjalmar Schacht, organized a stable fiscal economy in the *Reich* in the face of mounting armaments expenditures and the heritage of a weak economic structure. Some of his measures amounted to a subtle form of indirect taxation on the German people, as in the case of the maintenance of an internal and external price on the reichsmark.

In the United States there has occurred a steady decline in the number of fiscal responsibilities assumed by the State and local governments, when compared with the great increase in the financial tasks assumed by the Federal government. Especially after the first World War, Federal grants-in-aid were used to encourage certain activities on the part of State and local governments when it appeared that action on some pressing social problems could only come through the initiative of the Federal Government. The technique of the grant-in-aid is to make a gift of funds to a State if the State consents to engage in an activity considered worthwhile by the Federal Government, to exact certain requirements from the State organization in order to insure that the funds will be spent wisely and in conformance with general policy, and to supervise and investigate the conduct of expenditures. This procedure avoided the dangers of unconstitutionality, permitted necessary work to be done, and prevented uncontrolled spending by local governments. The grants were a means of centralizing the hitherto decentralized American federal system through a control over expenditures.

The line between public and private finance grew more undefined during and after the World War. Governmental agencies purchased stock in *ad hoc* organizations established for the duration of the war, and thus acquired the interests of a private corporation. The governmental corporation was a new type of financial body of the twentieth century in America, although

Finance, Public

England had seen a somewhat similar phenomenon in the East India Company and others. Instead of handling its finances, its receipts and expenditures, through the central fiscal office, it was designed to be self-supporting and productive of marketable goods or services. For example, the Home Owners' Loan Corporation, established in 1933, was a type of agency occupied with functions usually left to private finance. Nevertheless, in response to a public need, it was developed by the Federal Government. The Tennessee Valley Authority was another innovation in public finance.

The subject of war finance introduces new difficulties and complexities into the topic of public finance. The ordinary course of public economy is distorted by problems of how to raise huge sums of money immediately, how to maintain the credit of the nation abroad, how to devise new and just ways of exacting money through taxes, and how to float large issues of bonds. Notable after the World War was the similarity between wartime and peacetime economies. There was no sudden reversion to prewar financial conditions on the part of the great nations, and when the Second World War came in 1939, the national economies of the participating States were either already fully integrated and centralized as in the Fascist countries, or were soon regimented in an unprecedented fashion.

Considered in its modern form the science of public finance is usually divided into the study of Public Expenditures, Public Revenue, and Public Debt.

Public Expenditures differ widely in their extent and character, according to economic and social conditions, and according to the general attitude of the people toward government. In an agricultural or pastoral community, practically all the needs of life may be met by private initiative, and the government may have few functions except that of guardian of the public peace. The expenditures of government under such conditions will be narrowly limited. In an urban community, the individual may be impotent to meet the needs of tolerable existence; a wide range of functions must then be undertaken by government, and expenditures increased accordingly. In general, it may be said that public expenditures in all modern States are increasing more rapidly than population, and in some States more rapidly than wealth.

The principal expenditures of a modern State are for defense against foreign enemies and domestic disorder; for education; for the relief of poverty and sickness; for advancing the material interests of the State, through construction of roads, streets, and public buildings, and through the carrying on of services requiring collective action, as the postal service and, in some countries, railway transportation and other public utilities; and for the support of government administration.

In a federal government like that of the United States, expenditures must be distributed between the central and the State governments. Furthermore, since each State contains within it subordinate governments having a limited sphere of independent activity—cities, counties, towns—a further distribution of expenditures is necessary between State and local government. While the line is not sharply drawn between expenditures of the different governments, the cost of national defense against foreign foes is borne by the central government, as are also the cost of supplying services requiring uniformity throughout the country, as the postal service, and the cost of regulating commercial relations which pass beyond a single State. The expenditures for protection against internal disorder are borne in part by the State government, in part by the local government; and the same is true of expenditures for education. The expenditures for supplying collectively the needs of urban aggregations are naturally borne by the local government. (See EXPENDITURES, NATIONAL.)

Public Revenues.—The revenues of a modern State are derived from a great variety of sources. On account of important legal and economic differences, these are commonly classified as (1) permanent revenues and (2) temporary revenues, or revenues from loans.

Permanent revenues are classified as:

(*a*) Proprietary, including revenues from the public domain, expropriation, when resorted to, gifts, escheats, and some miscellaneous revenues.

(*b*) Regulatory and penal, including fines and penalties, and fees and license charges imposed for purposes of regulation or restriction.

(*c*) Commercial, or revenues which a government receives in the same way as a private corporation, from the operation of industrial enterprises, as the salt and tobacco monopolies of European and Eastern countries, the post office in the United States, and municipally owned public utilities.

(*d*) Taxation, including fees, special assessments, and taxes in the narrow sense. Fees are payments charged for government service or for the grant of a permit or privilege, as marriage license and mortgage registration fees. Special assessments are payments for public improvements levied upon the property benefited, as special assessments for street paving. Taxes, in the narrower sense, are compulsory charges levied by the government for public purposes, in accordance with some general principle of distribution, without regard to any special service rendered to the individual tax payer. These three types of payment are legally distinguished by the fact that the courts have consistently held that a fee must not exceed the cost of the service, and that a special assessment must not exceed the benefit conferred upon the property; while taxes may be levied without regard either to the service rendered or the benefit conferred.

Under modern conditions adequate revenues are a *sine qua non* for the successful existence of government. Recent years have afforded frequent, sometimes tragic illustrations of this fact in the desperate efforts made by newly established governments to develop adequate sources of revenue. Not infrequently the success or failure of these governments has depended upon their ability to accomplish this. In the United States this fact was recognized at the formation of the Federal Government by the provision that each State should have independent control over its own revenues, subject only to very general provisions of the Federal Constitution, designed to protect private property and individual liberty and to reserve to the Federal Government control over foreign and interstate commerce.

Three requisites of an efficient revenue system are generally recognized. In the first place it must provide sufficient revenue to meet the needs of the government and to carry on the various functions requiring collective action. In the second place, it must provide a steady income; either a deficit or a surplus in revenues may react unfavorably upon business, as well as upon the orderly processes of government. The third requisite is elasticity, allowing expansion in time of sudden need and contraction when undue surpluses begin to make their appearance, as in the United States in the latter part of the nineteenth century.

Temporary Revenues.—Loans were formerly resorted to largely in connection with war; but in consequence of the development

of credit facilities in modern times governments now borrow for a great variety of purposes. Indeed, among most Western nations, borrowing has become a regular process of government finance.

Government loans take a variety of forms, including issues of paper currency, treasury notes, tax warrants and other short term instruments, bonds, carrying usually an obligation for repayment of the principal, and annuities obligating the government to the payment of annual interest for long terms or in perpetuity, but not providing for repayment of the principal. These loans are placed upon the market by public advertisement and sale to the highest bidders, by public subscription at a price fixed by the government, and by sale to banking syndicates on stipulated terms for the purpose of resale to the public later. Provision for repayment generally takes the form either of sinking funds or serial payment.

It is a generally accepted principle that when debts are incurred for productive purposes they shall not mature before the undertaking for which they were incurred has had time to reach a period of productivity; nor, on the other hand, shall they be so dated that they will fall due after the undertaking has ceased to be productive. Since in modern States productive undertakings are more frequently carried on by local than by central governments, the greatest development of funded debt has taken place in the field of local finance. See DEBT, PUBLIC.

See the article UNITED STATES, section on *Finance*; also DEBT, PUBLIC; TARIFF; TAXATION.

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Financial Panics. See CRISES, ECONOMIC.

Fin'back, FINNER, FIN WHALE, or RORQUAL, any of four widely distributed species of whalebone whales of the genus Balænoptera. Their bodies are slender and elongated; and they have a well-developed dorsal fin placed two-thirds of the distance from the head to the flukes, and a characteristic series of longitudinal folds in the throat region. The whalebone is short, and the blubber of inferior quality.

The Lesser Fin Whale (*B. rostrata*) is the smallest of the four species, measuring from 25 to 33 feet in length; Rudolph's Rorqual (*B. borealis*) is from 40 to 52 feet long; the Common Fin Whale or Razorback (*B. musculus*), abundant off the eastern coast of the United States, measures from 60 to 70 feet; while Sibbald's Fin Whale (*B. sibbaldi*), which includes the great Sulphur Bottom of the Pacific, reaches a length of from 70 to 85 feet. See CETACEA; WHALE.

Group of Finches

1. Hawfinch. 2. Greenfinch. 3. Linnet. 4. Chaffinch. 5. Mountain Finch.

Finch, a name popularly applied to all the members of the family *Fringillidæ*, which includes a large number of small passerine birds such as the Sparrow, Linnet, Grosbeak, Goldfinch, Canary, and many others. The family comprises more than 1,000 species, and is widely distributed over the Northern and Temperate zones of both hemispheres, except Australia, where it is unknown. Characteristic features are the stout, conical bill, especially adapted to crushing seeds, and the presence of nine primary quills. There are bristles at the gape, and the nostrils are concealed by feathers or by a membrane. The color varies from the sober plumage of the house sparrow to the brilliant red and black of the cardinal; the power of song may be absent or highly developed. Finches are generally social birds, and frequent wooded districts and

open grassy places. They eat seeds, insects, buds, and leaves.

Numerous species of finch occur in the United States. Among well-known varieties are the Purple Finch, or Linnet; the Rosy Finches; the Grass Finch, known also as the Vesper Sparrow and Bay-Winged Bunting; the Summer Finches; Painted Finches, including the Indigo Bird (q. v.); Pinefinches; and Goldfinches.

See BULLFINCH; CANARY; CHAFFINCH; CROSSBILLS; GOLDFINCH; GREENFINCH; GROSBEAK; HAWFINCH; HOUSE FINCH; LINNET; SPARROWS; etc.

Finch, DANIEL. See NOTTINGHAM.

Finch, FRANCIS MILES (1827–1907), American jurist and poet, was born in Ithaca, N. Y. He was graduated from Yale (1849), and practised law at Ithaca. From 1880 to 1896 he was an associate justice of the New York court of appeals. He assisted in the organization of Cornell University, was an original trustee of the institution, and in 1892 became dean of its college of law. He wrote many popular lyric and college songs, including 'Nathan Hale' (1853) and 'The Blue and the Gray' (1867). These were published under the title, *The Blue and the Gray, and Other Verses* (1909).

Finch, HENEAGE, FIRST EARL OF NOTTINGHAM (1621–82), lord chancellor of England, was born probably at Eastwell, Kent, the son of Sir Heneage Finch, Speaker in Charles I's first Parliament. After the Restoration, when he was returned to Parliament, his eloquence, honesty, and ultra-loyalty raised him in turn to the solicitor-generalship, the attorney-generalship, and the office of lord chancellor (1674). He presided at the impeachment trial of Viscount Stafford (q. v.), in 1680.

Finch, WILLIAM ALBERT (1855–1912), American lawyer and educator, was born in Newark, N. J. He was graduated from Cornell University (1880), and admitted to the bar at Ithaca N. Y. From 1891 until his death he was professor of law at Cornell University. He published: *Finch's Selected Cases on the Law of Property in Land; The Law of Property in Land—a Syllabus.*

Finch'ley, a suburb of London, England, in Middlesex county; 7 miles northwest of St. Paul's. Finchley Common, now enclosed, was formerly a favorite resort of highwaymen. Pop. (1931) 58,961.

Finck, HENRY THEOPHILUS (1854–1926), American musical critic, was born in Bethel, Mo., was graduated from Harvard (1876), and studied in Berlin, Heidelberg and Vienna (1878–81). He became musical critic and general editorial writer on the New York *Evening Post* in 1881, and did much to stimulate popular interest in Wagnerian music in America. He made special studies of Chopin, Liszt, Grieg and MacDowell. In the field of psychology he was a staunch defender of the theory that romantic love is a modern sentiment, unknown to savage and ancient civilized nations. His works include, beside several books of travel, *Romantic Love and Personal Beauty* (1887); *Chopin and Other Musical Essays* (1889); *Wagner and His Works* (1893); *Pictorial Wagner* (1899); *Anton Seidl* (1899); *Primitive Love and Love Stories* (1899); *Songs and Song Writers* (1900); *Fifty Mastersongs* (1902); *Fifty Schubert Songs* (1903); *Grieg and His Music* (1909); *Fifty Grieg Songs* (1909); *Success in Music, and How it is Won* (1909); *Massenet and His Operas* (1910); *Food and Flavor* (1913); *Richard Strauss* (1917); *One Hundred Songs by Ten Composers* (1917); *Gardening with Brains* (1922); *Girth Control* (1923); *Musical Progress* (1923).

Finder, in astronomy, see TELESCOPE. In military science, see RANGE FINDERS.

Fin de Siècle, făn de sē-ā'kl ('end of the century'), a French phrase popularly applied, during the closing years of the nineteenth century, to whatever was most up to date or advanced in fashion, ideas, etc.

Findhorn', river, Scotland, rises in the Monadhliath Mountains, and flows northeast for 62 miles till it enters the Moray Firth at Findhorn village. Its waters abound in salmon and trout.

Finding of Goods. See LOST PROPERTY.

Find'lay, city, Ohio, county seat of Hancock county, on the Blanchard River, the Dixie Highway, and on the Baltimore and Ohio, the Cleveland, Cincinnati, Chicago and St. Louis, the New York Central, and the New York, Chicago and St. Louis Railroads; 45 miles s.w. of Toledo. It is the seat of Findlay College (q. v.). The city has machine shops and foundries, brick and tile works, sugar and oil refineries, iron and steel works, brick yards, cooperage works, and furniture, pottery, casket, traction ditcher, drug, rubber tire, cigar, glove and shoe factories. Pop. (1920) 17,071; (1930) 19,363.

Findlay College, a co-educational institution at Findlay, Ohio, founded in 1882 under the auspices of the Churches of God. It is a liberal arts college with the usual classical and scientific departments, and a number of others. For recent statistics, see table under the heading COLLEGE.

Fine (Latin *finis,* 'end'), a law term of two unconnected sets of meaning, one of them now obsolete, but historically much the more important.

(1) At present, a money penalty for a misdemeanor; originally in lieu of imprisonment, and mostly so still. The practice arose in England about 1300, under Edward I. Imprisonment was the legal penalty for certain offenses; but from favor to the powerful, or impossibility of enforcing it on them, they were allowed to 'make an end' of it by compounding it for money. Here the fine was not primarily a penalty, but just the reverse, an escape from one. In general, this alternative still persists, but exactly inverts the old idea. The magistrate lays a fine, and imprisons the culprit if unable to pay it, as the familiar '$10 or 10 days' of the police court, each day standing for its proportion of the fine. The statutes sometimes impose both fine and imprisonment, but usually one or other at the judge's discretion. Sometimes they impose the fine alone, as civil damages for injury to property; this, however, is not in the true sense a fine, but an *amercement* (q. v.), and is not penalty, but indemnity. (See PENALTY; PUNISHMENT.)

(2) An 'end' of litigation over landed property, by a lawsuit and recorded settlement. At first real, it was soon used as a weapon of business progress against feudalism. This lived by obstructing alienation of land, to perpetuate noble or manorial families; but entire success meant stagnation. Hence lawyers devised a collusive suit, in which the would-be buyer accused the owner of wrongfully keeping him out of the property; the latter admitted the charge, with abatements; and a composition was gravely agreed upon. The land passed in fee simple to the plaintiff on a money payment—barring out every claim of heirs, creditors, or others, not presented within a certain time. The record was made in three parts, the top two being given to the parties, the bottom or 'foot of the fine' filed with the court. See FEE TAIL.

Fine, HENRY BURCHARD (1858–1928), American educator and mathematician, was born in Chambersburg, Pa. He was graduated from Princeton University (1880) and from the Uni-

versity of Leipzig (1885). In 1881 he became tutor at Princeton, and was subsequently appointed to the Dod professorship of mathematics, a post which he held from 1891. He was dean of the faculty from 1903 to 1912, and in 1911 became dean of the departments of science. He published *The Number System of Algebra* (1891); *A College Algebra* (1905); *Co-ordinate Geometry* (with H. D. Thompson, 1909); *Calculus* (1927); and numerous papers on mathematical subjects.

Fine Arts (Italian *belle arti*, French *beaux-arts*, German *schöne Künste*), a general name for a whole group of human activities divided broadly into the major or greater fine arts of Architecture, Music, Painting, Poetry, and Sculpture, and the minor or subsidiary arts which include those dexterities and industries having elements of usefulness, pleasure, and beauty such as Cabinetmakers' Work, Embroidery, Jewelry, Pottery, Dancing, the Drama, and so on. See ART; ÆSTHETICS; ARCHITECTURE; DRAMA; MUSIC; PAINTING; POETRY; SCULPTURE.

Fine Arts Commission. See COMMISSION OF FINE ARTS.

Fingal, fin'gŏl, FINN, FIONN, or FIND, an Irish epic hero, the great leader of the Fenians, Fingalians, Fians, Fianna, or Feinne, a band of professional warriors belonging, according to Gaelic tradition, to about the third century A.D. He is said to have been the son of Cumhail, a leader of the Leinster warriors, and the father of Ossian (q. v.). The sagas of the Fenian or later heroic cycle of Ireland are largely devoted to the exploits of Fingal. His magnificent abode at Almhain in Kildare is described; his wooing of Grainne, daughter of Cormac, is recounted; and the adventures of the Fenians in war and the chase are narrated. Each of these warriors was bound by vows never to receive a portion with a wife, but to choose her for her good manners and virtues; never to offer violence to any woman; never to refuse any one anything he might possess; and never to flee before less than ten champions. The band was overwhelmingly defeated at Gawra, in County Meath, by the Gaels under Cormac MacArt, who deposed them from their position of suzerainty; and although Fingal escaped from the battle, he was slain soon after at Athbrea on the Boyne (282 or 283 A.D.). A great body of tradition, much of it conflicting, has gathered about the name of Fingal, but there seems to be little doubt that he was an actual historical personage.

Fingal's Cave. See STAFFA.

Finger. See HAND.

Finger Prints, a method of personal identification, widely employed at the present day. In finger-print systems the fingers are inked, and impressions taken on cards, which are then classified, compared with prints previously filed and then filed if no duplicate is found. Such a system determines identity with absolute certainty, if the prints are compared and the ridge characteristics correspond; for finger prints remain the same through all other bodily changes, and even after death, as long as the body lasts. Not once in 10,000 years, or 1 in 64,000,000,000, prints, it has been estimated, would the finger prints of a person be duplicated.

The use of finger or thumb prints dates back to very early times, and recent researches show that as long ago as 200 B.C. the Chinese resorted to an impression of the thumb as the signature for business and legal transactions. In 1858 Sir William Herschel, of the Indian civil service, introduced the practice of taking finger prints when he was in executive charge of the Hugli district, Bengal, in order to prevent impersonation. In 1897 Sir E. R. Henry, then inspector-general of police for the lower provinces, formulated a scheme of classification which was a development of the proposals of Professor Purkinje in 1823 and of Sir Francis Galton, to whom we chiefly owe our knowledge of the markings on finger tips, at a much later date. As the outcome of much experimenting, Henry recommended a fourfold classification—*viz.*, arches, loops, whorls, and composites—while adopting many of Galton's terms, accepting his definitions, and following his suggestions whenever practicable. The governor-general thereupon directed that the Henry system for the identification of criminals should be adopted throughout British India; and it was later introduced into all branches of public business in India and Burma.

In England a committee appointed in 1900 had placed before it the results of the working in India of the finger-print method under Henry's classification, and on its recommendation the Home Secretary in 1901 sanctioned the adoption of the system by the police of England and Wales, in place of the anthropometric system. Since then, some system of finger prints has been installed by the police of practically every great city of the world.

In the United States the system is now used in the police departments of all the large cities; in the War Department and the Marine Corps, to detect deserters attempting to re-enlist; in the Interior Department for making agreements with Indians who cannot write; and in the work of the Bureau of Investigation of the Department of Justice. This bureau works in conjunction with the police departments of many cities, not only in the United States, but in foreign countries and has been instrumental in identifying many persons afterwards convicted of crimes, as well as of exonerating some who were not guilty.

The finger-print system is being extensively applied, also, in many forms of business enterprise, especially banks and insurance companies, and proposals have been made for the fingerprinting of all aliens, and even of the entire population. The advantages of this, it is contended, would be the possibility of absolute identification at all times. Numerous hospitals are now taking foot prints of babies immediately after birth. Although it has been argued that a mould can be made of any finger print by means of a photographic process and with this mould reproduce and transfer the prints at will so as to render them unreliable, all efforts to reproduce a print, in which the defects were not readily detected, have failed; thus the probability of the evidence in criminal cases being fabricated to the detriment of innocent persons is *nil*. The palm and foot prints are now associated with finger-prints and recognized as a reliable medium for establishing identity, convictions for murder on a palm print in Nevada (1918) and a foot print in Massachusetts (1937) having been upheld by the Supreme Court.

The term finger print or impression is applied to any reproduction of the ridges on the nail joint of the finger, whether by means of ink, blood, or the sweat from the finger itself. Every system of identification is based on the general formation of these ridges, of the two fixed points therein, and of the ridges surrounding these points. The usual appliances for obtaining finger prints consist of a slab of tin, marble, glass, aluminum, or other hard, smooth substance, over which a thin film of ink is spread by a small printer's roller or one of resilient rubber. Impressions are usually taken in two ways on ordinary white paper with the surface not too highly glazed; these are called *rolled* and *plain* impressions. To take a rolled impression, the bulb of the finger is placed on the inked

slab, and the finger turned over until the bulb, which originally faced to the left, faces to the right. It is then pressed lightly and in the same way upon the paper, and a clear rolled impression of the finger surface is thus obtained. A plain impression is secured by placing the bulb of the finger on the inked slab, and then impressing it on the paper without any turning movement. The standardized procedure at the present time is to take both rolled and plain impressions. The complete record of such a set of impressions, as used by the Department of Justice, is contained on a card eight inches square, and can be taken by an expert in less than a minute.

Consult Francis Galton, *Finger Prints;* Sir E. R. Henry, *Classification and Uses of Finger Prints;* F. Kuhne, *Finger-Print Instructor* (1935); Sir W. J. Herschel, *The Origin of Finger Printing* (1916); Wentworth and Wilder, *Personal Identification* (1918); E. H. Murphy, *Finger-Printing for Commercial and Personal Identification* (1922); H. A. Fauld, *A Manual of Practical Dactylography* (1923); Hakon Jorgensen, *Distant Identification and One Finger Registration* (1923); J. A. Larsen, *The Finger-Print System* (1924); *How to Take Finger Prints* (U. S. Department of Justice, 1924); H. Battley, *Single Fingerprints* (1930); H. A. Frankel, *Finger Print Expert* (1932).

Revised by FREDERICK KUHNE, *Finger Print Expert.*

Fingoes, See BANTU.

Fin'ial, an ornament, generally carved to resemble foliage, which forms the termination of pinnacles, gables, spires, and other portions of Gothic architecture. There are traces of foliated terminations, both in stone and metal, on the pediments of classic buildings, but it was not till the twelfth century that the finial proper was introduced. During the latter part of that century and the whole of the thirteenth century, finials were used as the crowning ornaments of every salient point in the buildings of the period.

Forms of Finials

Finiguerra, fē-nē-gwer'rä, MASO (1410–61), Italian goldsmith and engraver, was born in Florence. Both Benvenuto Cellini and Vasari bear witness to his renown as a goldsmith. The latter ascribes to him the invention of printing designs from engravings on metal, but it is probable that he did no more than introduce the art into Italy. Many proofs ascribed to him still exist, notably *The Crowning of the Virgin* in the National Library, Paris.

Fining, or CLARIFICATION, the process of clearing turbid liquors, such as beer, wine, or spirits. The simplest method is by filtration (see FILTERS), which is sufficient for the removal of impurities mechanically suspended, but which will not successfully remove mucilaginous or other gummy material. In the case of beer, fining is accomplished by the addition of a solution of isinglass in sour beer or sulphurous acid. The isinglass unites chemically with the tannic acid present in the beer, and forms a gelatinous precipitate that sinks to the bottom of the cask, carrying with it the matter in suspension. Syrups and other liquors, that may be heated without injury, are clarified by the addition of albumin, which coagulates on heating. The scum thus formed attracts and envelops all the suspended impurities. Wines and cordials are also clarified by the use of albumin, the alcohol itself acting as a coagulant. Isinglass, ox blood, and potassium ferrocyanide are also sometimes used for clarifying wines. Spirits are fined by the addition of alum and a solution of sodium carbonate.

Finistère, fē-nēs-târ' ('Land's End'), extreme western department of France, bounded on three sides by the Atlantic Ocean. It is traversed from east to west by two low but picturesque chains of hills, clad with fir trees and heath, with fruitful valleys of meadow land between. Its coast is rugged and broken, its shores bristling with dangerous granite rocks, and fringed with many islands. The temperature in general is low, the climate humid. There are a number of coast streams, including the Odet, Elorn, and Aune. The department is densely peopled, and is richly fertile, producing especially cereals. Flax is cultivated, and cattle and horses are reared. The sardine fisheries are important. Shipbuilding is carried on at Brest (q. v.), the chief town, and linen is manufactured at Landerneau. There are lead mines of considerable value. Quimper (q. v.) is the capital. Area 2,729 square miles. Pop. (1936) 756,793.

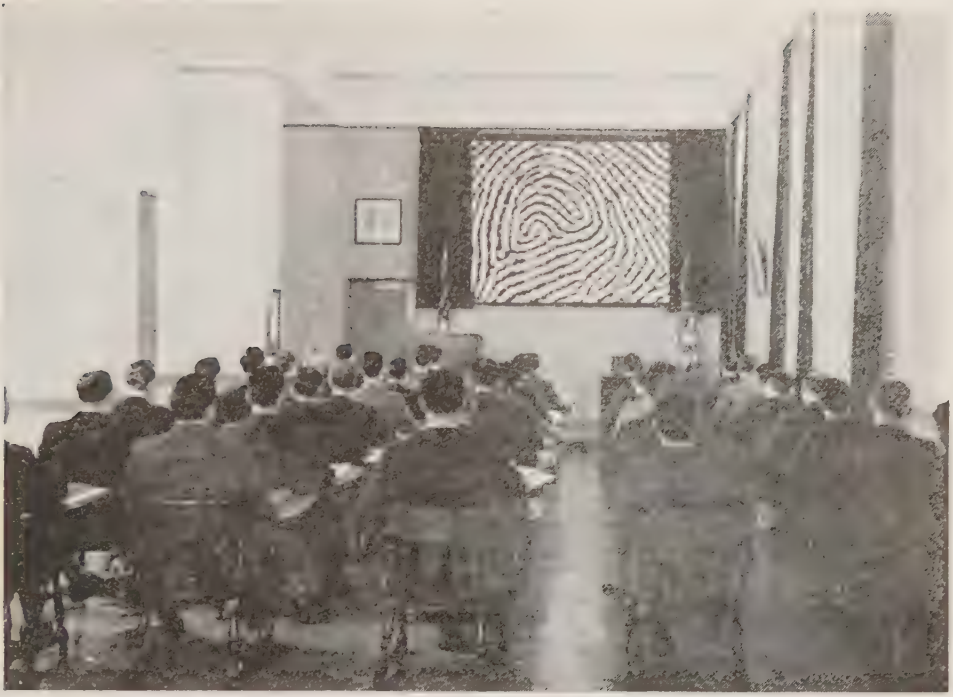
Finisterre, Cape, fin-is-târ', promontory at the northwest extremity of Spain, on the Atlantic Ocean. Off the Cape the British gained two naval victories over the French in 1747.

Fink, ALBERT (1827–97), an American engineer of railroads, born in Germany. He constructed a noteworthy truss bridge across the Ohio River at Louisville and invented the Fink type of truss construction while superintendent of the Louisville and Nashville Railroad after the Civil War.

Fink, MIKE, king of the keelboatmen on the Ohio and Mississippi Rivers, hero of many legendary exploits, born about 1770. He served as Indian scout at Fort Pitt; became king of keelboatmen on the Ohio during the early Westward movement; and later joined the first Ashley expedition up the Missouri River and was fatally shot in a quarrel in 1822. Consult Meine, F. J., and Blair, W., *Mike Fink* (1933).

Fin'land (Finnish *Suomen Tasavalta*), formerly an autonomous grand-duchy of Russia, declared its independence Dec. 6, 1917, and became a republic under the Constitutional Law of July 17, 1919. It was formally recognized as an independent nation by European and other Powers. It lies, roughly speaking, between 60° and 70° N., and between 20° and 33° E., with the Gulf of Bothnia on the west and the Gulf of Finland on the south. It has an extreme length of about 650 miles, and a breadth, along the 62d parallel, of 370 miles; and its total area is about 135,550 sq. mi., including land and water. About one-tenth of its area is covered by lakes and marshes, from which comes the native name 'Land of Waters.'

In its granite formations, indented lakes, and rocky basins filled with water, Finland resembles Sweden; in its absence of mountains, or even of hills, it is not unlike the Russian plains. The chief rivers are the Tana, Muonio, Tornea, Kemi and Ulea. The interior of the country is occupied by countless lakes, some of vast size, and mostly connected with one another naturally or artificially by means of canals. The largest of the lakes was Lake Ladoga, ceded to Russia in 1940. Among others are Lakes Saïma, Enare, Kemi, Ulea and Päjänne. The coasts, like those of Sweden, are broken by numerous indentations and fringed with islets (Qvarken, Aland, etc.). The climate is severe in winter, but is dry and hot in summer. The ground is generally covered with snow from the middle of November till April; then follows a brief spring, accompanied by a rapid growth of vegetation. Autumn is likewise short, Septem-



SPECIAL AGENTS OF THE FEDERAL BUREAU OF INVESTIGATION STUDY FINGER PRINTS AS PART OF THEIR TRAINING

Official Photographs, Federal Bureau of Investigation

A PORTION OF THE FINGER PRINT FILES OF THE FEDERAL BUREAU OF INVESTIGATION, WHERE THE FINGER IMPRESSIONS OF CRIMINALS ARE CLASSIFIED AND COMPARED

Finland

ber being often very fine and October wet.

Among wild animals are the bear, wolf, fox, lynx, ermine, otter and hare. Salmon, trout, perch, pike, gwyniad and other fish abound in most of the rivers, and fishing gives employment to a large portion of the population.

The mineral riches of Finland are limited, except for its incomparable granite, the finest supply of which comes from the Piterlaks quarries, 50 miles west of Viborg. Silver, copper and iron are also worked. The forests are of vast extent, covering 62,429,000 acres, of which 24,835,000 acres belong to the State. Northern pine and Norway spruce are the most widespread and productive; then come the birch, alder, ash and oak. The national industries depend largely upon the forests, and forest products form the most important part of the country's exports.

Agriculture is the chief occupation, although the cultivated area only covers 6.6 per cent of the land. The principal crops are rye, barley, oats, potatoes and hay. Cattle raising and dairy farming are of importance. Agriculture is encouraged by land purchase legislation under which every tenant has the opportunity of becoming owner of his leasehold, the redemption or purchase price being paid to the landowner in 5 per cent bonds guaranteed by the government; the government is paid by the tenants in specified yearly instalments which are collected jointly with the taxes. Another important factor in agricultural development has been the co-operative movement, especially as represented by agricultural credit societies and co-operative creameries.

The manufacturing industries of Finland have developed greatly since the latter part of the nineteenth century. One great factor in industrial progress is the cheapness and availability of water power. There are in the country some 1,440 rapids, the best known being those in the course of the Vuoksi River. The principal industrial establishments are iron and mechanical works, textiles, wood industries, paper and pulp, leather, rubber and fur, chemicals, graphic arts, tobacco, and electricity, gas and water.

Finland's foreign trade is with most European countries, United States and Latin America. The chief exports are animals (living), food obtained from animals, timber, pulp and paper, leather, hides, furs, minerals and earths, gums, resins and tar, matches and explosives; imports are cereals, colonial produce and spices, spinning materials, textiles, metals, leather, hides, furs, machinery, minerals and earths.

Internal communication depends on the lakes connected with each other and with the Gulf of Finland by canals, navigable at a length of about 3,000 miles and floatable at a length of about 29,000 miles. There are 3,400 miles of railroad and a well developed telegraph and telephone system. There is railroad connection with Sweden and Russia, and passenger boat and airplane connection with most of the countries of Western Europe, and telephone connection with most countries of the world.

The population of Finland (1937) was 3,834,662. Over 82 per cent are Finnish-speaking, 9 per cent Swedish. Nearly all the inhabitants are Lutherans. Finland is known for its excellent educational system and for the very low rate of illiteracy (less than 0.9 per cent). There are three universities, one at Helsinki (Helsingfors), and two at Turku (Abo).

Under the Russian régime the emperors of Russia were at the same time grand dukes of Finland. In accordance with the proclamation of Dec. 6, 1917, the government is a Republic headed by a president, elected for 6 years, and a House of Representatives of 200 members chosen by direct vote of the people (men and women) and serving for three years. Helsinki (Helsingfors) is the capital; pop. (1938) 293,237.

The revenues are derived from customs duties, State property (railroads, timber lands, water power), and direct taxes. The principal expenditures are for education, communications and public works, and public debt charges. The *markka* (finmark), the monetary unit, has a par value of $0.0426.

History.—The Finlanders belong, as their tongue indicates, to the great Turanian or Ural-Altaic family, which still predominates in North and Central Asia. About the end of the seventh century the Finns, driven as it is supposed by the Bulgarians from their settlements on the Volga, took possession of the country they now occupy. In the twelfth century the Swedes turned their attention to Finland, more especially for the introduction of Christianity; but the struggle with paganism was long and obstinate, lasting for nearly two hundred years. Three separate crusades (1157, 1249, 1293) finally brought about the subjection of the country to Sweden, and the adoption of the Christian religion.

In 1721, by the Treaty of Nystad, Peter the Great annexed to Russia not only Ingria and Livonia, but also a great part of Karelia, including Viborg. In 1743, by the Peace of Abo, the Empress Elizabeth extended Russian Finland to the Kymene; and in 1809 the entire principality was conquered by Alexander I, who, however, restored to it the Viborg province. The Swedish constitution, dating from 1772, was preserved by special grant of Alexander I, and renewed by his successors.

In 1899 a manifesto asserted the right of Russia to legislate in Finland without the consent of the Finnish Diet on any matter bearing on Russian interests; in 1900 the Russian language was ordained as the official language; and in 1901 the Finnish military system was superseded by the Russian. The bitter discontent thereby engendered found expression in the assassination of Bobribov, the Russian governor-general, and Johansson, the Russian procurator-general. In 1905 the objectionable decrees of 1899–1903 were withdrawn; and in 1906 a reformed constitution went into effect, with universal suffrage, free speech, a free press, and the right of public meeting.

The Russifying policy was resumed in 1909–10, however, when a Russo-Finnish commission reported in favor of reducing the duchy to a province, with representation in the Duma and in the Council of the Empire. In August, 1911, Kivinebe and Nykirka, parishes of Viborg province, were added to the government of Petrograd (St. Petersburg), a measure regarded as the first step in the partition of Finland.

With the outbreak of the World War in 1914, still further measures were taken to strengthen Russian control. The Russian Revolution (March, 1917), however, weakened Russia's hold, and on July 20, 1917, the Finnish Diet proclaimed the independence of Finland, which it further defined on Oct. 7, 1917, as a republic within Russia. Complete independence was declared on Dec. 6, 1917. Civil war ensued between the White Guards, or conservative element, and the Red Guards or radicals supplemented by Russian Bolshevists. German forces intervened in February, 1918, in behalf of the White Guards, and with their help the Red element was eventually overthrown. A treaty of peace was concluded between Germany and Finland, and a movement to establish a Finnish monarchy under a German prince gained a considerable following, but defeat of Germany

Courtesy Finnish Central Chamber of Commerce, Helsingfors

TYPICAL FINNISH LAKE SCENERY

Homer Smith photo, Chicago

FACTORIES IN TAMPERE, FINLAND, "THE SMOKELESS CITY"
Mills and manufacturing plants in this industrial Finnish city are driven by water power.

by the Allied Powers put an effectual end to that project.

A republican form of government was then determined upon, the constitution was ratified at Helsinki, July 17, 1919, and on July 25, 1919, Prof. Kaarlo Julio Staalberg was chosen first president of the new Republic. The following year a treaty was concluded with Soviet Russia (Oct. 14, 1920), which ensured Finland possession of Pechenga and free access to the Arctic Ocean; gave her control of the islands in the Gulf of Finland, which were strategically important for purposes of national defense; and guaranteed full autonomy to Eastern Karelia, which had a considerable Finnish population.

A dispute with Sweden over the Swedish-populated Aland Islands (taken by Russia from Sweden in 1809 and seized by Finland in 1917 as a necessary western defense) was decided in Finland's favor in 1921 by the League of Nations. The Karelian question, long a Russo-Finnish bone of contention, continued a serious issue through 1923 and 1924. In August 1925 King Gustav of Sweden visited Helsinki, being the first Swedish monarch to visit Finland since 1809. Finland, meanwhile, had joined the League of Nations in 1920 and was elected to the Council of the League in 1927. For years Europe's only Prohibitionist nation, Finland repealed her liquor statute by law in 1932.

In October 1939 Soviet Russia demanded the cession of a portion of the Karelian Isthmus, together with certain other military and naval concessions, offering in return a strip of Russian Karelia. Similar demands against Lithuania, Latvia, and Esthonia had already been successful. Finland, however, was adamant in her refusal and on Nov. 30, 1939, Russia opened hostilities by bombing Helsinki. Despite brilliant resistance, the vastly outnumbered Finnish troops were gradually forced into a retreat which culminated on March 13, 1940, with the signing of a treaty of peace ending hostilities.

See the articles under the headings Russo-Finnish War; World War, The Second.

Bibliography.—Consult T. W. Atchley, *Finland* (1931); J. H. Wuorinen, *Nationalism in Modern Finland* (1931); K. Gilmour, *Finland* (1931); A. J. Pearson, *The Land of a Thousand Lakes* (1932); R. Nummelin, *Some Aspects of the Geography of Finland* (1935); A. Rothery, *Finland, the New Nation* (1936); M. W. Graham, *The Diplomatic Recognition of the Border States* (1936).

Finland, Gulf of, an arm of the Baltic Sea, between Finland on the north and Esthonia on the south. Its length is 260 miles; its breadth varies from 25 to 90 miles. See Baltic Sea.

Finland: Language and Literature.—Swedish was formerly the official language, but in 1883 Finnish and Swedish were placed on an equal footing. *Suomi*, the language of the Finns throughout Finland, Lapland, and the Baltic provinces, belongs to the Finno-Ugric branch of the Uralo-Altaic family, and is closely allied to the Magyar or Hungarian. It is agglutinative, with some tendency to inflection, and progressive vowel harmony is conspicuous. There are fifteen case terminations, and the grammatical relations between the parts of a sentence are expressed by suffixes. Article and prepositions are wanting, and the verb has only present and past tenses, the future being expressed by a circumlocution.

Until a century ago the *literature* of Finland was almost solely employed in works of a religious character. In 1822 Zachris Topelius published a collection of scattered songs. In 1835 Elias Lönnrot (q. v.) gave to the world his famous epic *Kalevala* (q. v.), being a systematic collection of popular songs taken down from the lips of the peasantry during years of patient research and wandering.

During the last fifty years there has been a notable increase of literary activity in Finland. Most of Shakespeare's plays have been translated into Finnish by P. Cajander, and the standard works of England, France, Germany, and Russia have long since been rendered into that language. There are a great many Swedish and Finnish newspapers, and scientific or literary journals. The Society of Finnish Literature has fostered the editing of precious collections of epical songs, ballads, and fables. Porthan and Koskinen are the principal historians. Runeberg (q. v.) is the greatest poet and dramatist.

Among the prominent poets of Finland may be named Malmström (q. v.), Gripenberg, Jännes, Wecksell, J. H. Erkko, A. V. Koskenniemi, Tavaststjerna, Eino Leino, Kasimir Leino, Alexis Stenwall (Kiwi), J. Linnankaski, Aho, Vesainen, Järnefelt, Canth, and Kurikka are leading Finnish novelists and dramatists. Finnish music is highly developed; the compositions of Pacius, Greve, Kajanus, Järnefelt, Merikanto, and Jean Sibelius being noteworthy. Finnish art has also reached a high standard modern representatives being Edelfelt, Axel, Gallen, Wiiks, Takanen, Walter Runeberg, Dalström, Sjoström, and Nyström.

Fin'lay, George (1799–1875), English historian. Moved by the Hellenic struggles for independence, he visited Greece in 1823, and, with Byron and other enthusiasts, entered actively into that cause. After independence had been won (1829) he settled near Athens, and devoted his time and fortune to agricultural and fiscal reforms. The first portion of his great work, *Greece under the Romans,* appeared in 1844, and was followed by succeeding instalments. The complete history was republished at Oxford in 1877 with the title, *History of Greece from B.C. 146 to A.D. 1864.*

Fin'ley, John Huston (1863–), American educator, administrator, author and editor, was born in Grand Ridge, Ill. He was graduated from Knox College in 1887 and also studied at Johns Hopkins University. He was secretary of the New York State Charities Aid Association (1889–92) and editor of *The State Charities Record* and *The Charities Review* (now *The Survey*). He was president of Knox College, 1892–99. In 1900 he was called to the newly established chair of politics at Princeton University and in 1903 became president of the College of the City of New York. He reorganized the College and made it the prototype of the municipal university supported by the city.

In 1913 Dr. Finley was chosen president of the University of the State of New York and Commissioner of Education. He resigned in 1921 to join the editorial staff of *The New York Times*, of which he became editor-in-chief in 1937. During 1910–11 he was Harvard University exchange professor at the Sorbonne, Paris, lecturing on the early French in America. Preparatory thereto he made an extended journey on foot and by water from the Gulf of St. Lawrence to the Gulf of Mexico. These lectures were later published as *The French in the Heart of America* (1914). He was a member of the arbitration board in the Eastern railway controversy (1913) and served as chairman of the State Commission for the Blind (1913–15); also as a member of the New York Constitutional Convention Commission (1914). In 1918–19 he served as Commissioner of the Red Cross to Palestine and the Near East, with the rank of lieutenant-colonel. He was elected member of the American Academy of Arts and Letters.

Dr. Finley has received nu-

Courtesy Finnish Central Chamber of Commerce, Helsingfors

RAILWAY STATION IN HELSINGFORS, FINLAND

merous degrees from institutions of learning; was decorated by the King of Italy, the Emperor of Japan and the President of France (Legion of Honor), also received decorations from Finland, Czechoslovakia, Serbia, Poland, Greece, Sweden, Norway and Lithuania. He became Director of the Hall of Fame in 1931.

In 1907 Dr. Finley was appointed Editor-in-Chief of Nelson's *Loose-Leaf Encyclopedia*. A frequent contributor to educational and literary reviews, he published *Taxation in American States and Cities* (with Richard T. Ely, 1889); *The American Executive and Executive Methods* (with J. F. Sanderson, 1908); *French Schools in War Time* (1917); *A Pilgrim in Palestine* (1919); *The Debt Eternal* (1923) and *The Mystery of the Mind's Desire* (1936).

Finley, JOHN PARK (1854–), American meteorologist, was born in Ann Arbor, Mich. He was educated at the State Normal School and the State Agricultural College, and then entered the U. S. Weather Bureau. He devised the system of weather reporting by volunteer observers, and was subsequently placed in charge of the Signal Service Bureau on the Pacific Coast. He invented signal apparatus used in army signalling, and made valuable meteorological studies, especially on tornadoes. His published works include: *Manual of Instruction in Optical Telegraphy* (1889); *Essay on the Development of Tornadoes* (1890); *Climatic Features of the Two Dakotas* (1893).

Finley, ROBERT (1772–1817), American clergyman, was born in Princeton, N. J., and was graduated from the College there (1787). From 1793 to 1817 he was connected with his alma mater, and in 1795 was ordained Presbyterian pastor at Basking Ridge. To him is largely due the formation of the American Colonization Society for colonizing parts of Africa with emancipated slaves. In 1817 he became president of the Franklin College, Athens, Ga.

Finn. See FINGAL.

Finn, HENRY J. (1782–1840), American actor, was born in New York City. He first appeared on the stage in that city, and in 1801 went to London, where he became a member of the Haymarket company. In 1822 he returned to the United States, attaining success in eccentric parts, such as *Paul Pry* and *Dr. Pangloss,* and subsequently starring in various cities with monologue variety entertainments. He perished in the ill-fated *Lexington,* which was burned in Long Island Sound. He wrote several dramas and a *Comic Annual.*

Fin'ney, CHARLES GRANDISON (1792–1875), American clergyman and evangelist, was born in Warren, Conn. He studied law, but in 1824 joined the Presbyterian ministry, and met with remarkable success as an itinerant evangelist. In 1834 he became the first pastor of the Broadway Tabernacle (Congregational), New York City; in 1835 was made professor of theology at Oberlin College; in 1837 pastor of the Presbyterian church at Oberlin; and from 1851 to 1866 served as president of the College. In 1849 and 1858 he carried on successful evangelical campaigns in Great Britain. He founded and edited *The Oberlin Evangelist* (1839–63); and published: *Lectures on Revivals* (1835; 14th ed. 1868); *Lectures on Systematic Theology* (1847). Consult his *Memoirs.*

Finney, JOHN MILLER TURPIN (1863–), American surgeon, was born in Mississippi, and removed with his father to Maryland at an early age. He was graduated from Princeton University (1884) and from Harvard Medical School (1889), and took up the practice of medicine in Baltimore. He has been a member of the surgical staff of the Johns Hopkins Hospital from its beginning, in 1889, as Chief of the Surgical Dispensary, and Assistant, Associate, and Clinical Professor of Surgery, Johns Hopkins University. In 1922 he succeeded William S. Halsted as head of the Surgical Department, from which position he retired in 1925, retaining, however, the professorship of surgery. He served in France during the World War (1914–19) as chief consultant in surgery, American Expeditionary Forces, and was awarded the Distinguished Service Medal (U. S.).

Finnish Language. See FINLAND: LANGUAGE AND LITERATURE.

Finn'mark, the most northerly province of Norway, consists of a narrow strip of rocky coast land, cleft by numerous bays and fiords. The chief sources of wealth are fishing and reindeer breeding. Hammerfest (q. v.) is the capital. Area, 18,572 square miles. Pop. (1930) 53,308.

Finns. See FINLAND.

Fins, membranous processes whereby fish and other aquatic animals propel, balance, and steer themselves in the water. They may consist of simple cutaneous folds; but in fish they are usually supported by bony or cartilaginous rods or rays, which may be either unbranched and unjointed (spines), or branching and finely jointed (soft rays). Both types may be present in a single fin. The fins of the fish are of two kinds—paired and unpaired, or median. There are two sets of paired fins, the pectoral and ventral, articulated respectively to the shoulder girdle and the pelvic girdle, and corresponding to the anterior and posterior limbs of the higher vertebrates. There may be a single continuous unpaired fin occupying the dorsal and ventral middle lines, as in certain primitive forms, or one divided into several parts described as dorsal, caudal, or anal, according as they occur on the back, the tail, or the lower median line.

Various modifications occur. Thus, the ventral fins may be united to form a powerful sucker, as in the lumpsucker (q. v.), or the pectorals may be greatly enlarged, as in the flying fish (q. v.).

Fin'sen, NIELS RYBERG (1860–1904), Danish physician, was born in Thorshavn, Faroe Islands. He was graduated from the medical school at Copenhagen (1890), and became demonstrator of anatomy at the University of Copenhagen. By a series of researches he showed that the effects of light upon biological processes are mainly due to the violet and ultra-violet rays of the spectrum (see ACTINIC RAYS). The *Finsen Light,* employed to destroy certain pathogenic organisms, as in lupus, favus, ringworm, and alopecia areata, concentrates the rays of an electric arc lamp by means of a lens composed of one flat and one curved disk, between which is interposed a solution of copper sulphate. In 1896 an institute was established in Copenhagen, under Finsen's supervision, for the treatment of diseases. In 1903 he was awarded the Nobel Prize for medicine. He wrote: *Chemical Rays and Variola* (1894); *Phototherapy* (1901). Consult Dickson's *Life.*

Finsteraarhorn, fin-ster-är' hôrn, the loftiest summit (14,026 feet) of the Bernese Oberland (q. v.).

Fiord, FYORD, or FJORD (Danish), is a glaciated valley partly filled by the sea. It possesses the characteristic U section of such a valley, and has steep sides, over which small streams fall in cascades. Fiords are shallower at the mouth than farther inland, owing to morainic accumulations; while the upper end becomes shallow, owing to the formation of a delta by the inflowing river. Fiords are formed by the drowning of old glaciated valleys due either to crustal or sea-level changes, or to the melting of the ice which filled the

valley below the level of the sea, as the ice would not float until nine-tenths of it was submerged. They are independent of rock structures, for they occur in young folded mountains in N. and S. America and in New Zealand, in old denudation highlands on both sides of the northern part of the Atlantic. The best known are the fiords of Norway and the sea-lochs of W. Scotland. The fiord scenery, combining that of mountain and sea, and in many parts also that of

Paul's Photos, Chicago

GEIRANGER FIORD, NORWAY

Its mountainous walls are more than five thousand feet high; its depth, unmeasured.

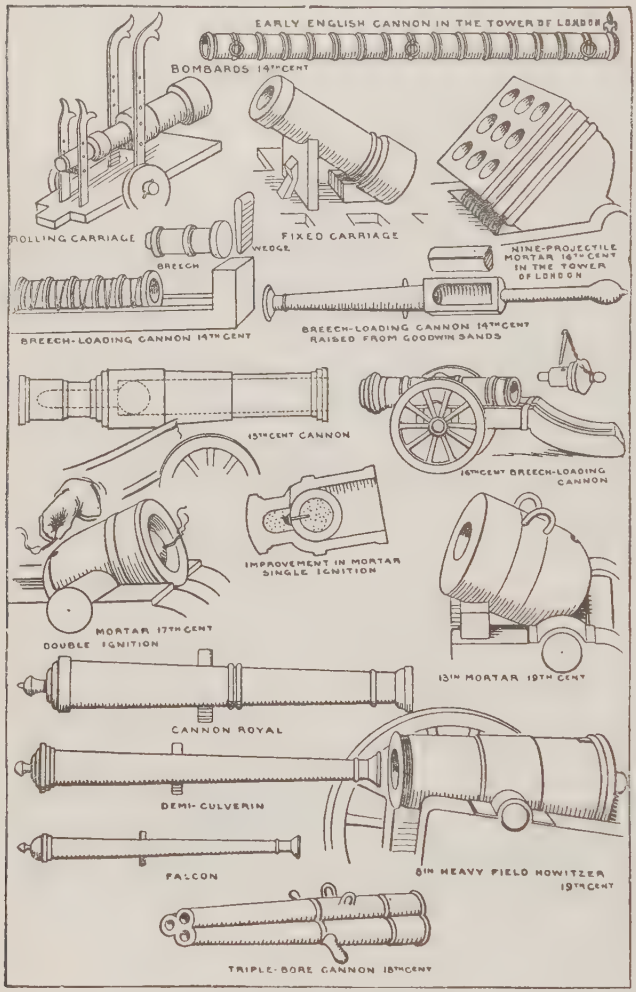
ice-fields, is among the most sublime and beautiful. Fiords form excellent harbors, but as they have no easily accessible hinterland they are of little commercial importance, except for fishermen.

Fir is a term loosely applied to several conifers, but should be confined to the genus *Abies*, characterized by its leaves growing spirally round the branches. The balsam fir (*A. balsamea*), with dark foliage fragrant when drying, and used for cushions, is found in Canada and the north-eastern states. Its bark is smooth, blistered with resinous exudations from which Canada balsam is derived. Its ovoid or cylindric cones are erect on the leafy branches. The silver fir of the south of Europe (*A. picea*) is distinguished by flat leaves and erect cones; the spruce fir has tetragonous leaves and drooping cones. The common or Norway spruce fir (*A. excelsa*) is widely distributed over N. and Central Europe, and flourishes in situations much too severe for any of the pines. The timber of this tree is the deal of commerce, and is also imported, unsawn, for masts, etc. Burgundy pitch is another product of the spruce fir.

Fir-Bolg (*i.e. Bolg-Men*), the name given in Gaelic traditional history to one of the earliest races of Ireland. They are said to have come from Greece, where they worked as serfs. In Ireland they figure as drudges (Lady Ferguson's *Irish before the Conquest*, 1890, p. 32). Modern ethnologists agree in believing them to have been of Iberian stock, small of stature and dark in complexion. They are stated to have colonized Ireland as victorious invaders, but to have been conquered in their turn by the Danaans. Skene (*Celt. Scot.*, i. 138 *n.*) regards as authentic the statement that Fir-Bolg refugees, ousted from Ireland by the Gaels, settled in the Isle of Man, Arran, and the Hebrides, and there are still the ruins of a Fir-Bolg fort at St. Kilda. Nevertheless, Mac-Firbis, a Galway genealogist of the 17th century, asserts that in his day the descendants of the Fir-Bolg formed the most numerous of the various sections of the people of Ireland, being at the same time the most despicable—thieves, churls, and serfs.

Firdausi, or FERDUSI (*c.* 940–1020), the poetical title of Abu'l Kasim Mansur, Persian poet, author of the great epic, *Shāhnāmah*, or *Book of Kings*, which contains the legendary annals of the ancient monarchs of Persia down to the Arab invasion in 651 A.D. Firdausi, a native of Tus, labored upon the *Shāhnāmah* for thirty-five years, and then presented the book to Mahmud. But, displeased by his reward, he fled to the caliph of Bagdad, for whom he composed the poem of *Yusuf*

and Zuleikha, describing the loves of Joseph and Potiphar's wife. After some years he ventured back to his native city of Tus, Sultan Mahmud having repented of his treatment of the poet. Firdausi also left a collection of



Old Types of Firearms.

miscellaneous poems. Between 1838 and 1878 the whole of the *Shāhnāmah* was translated into French by J. Mohl. A part of an English version by Atkinson was published in 1832 (new ed. 1892). Rückert also translated a portion into German (new ed. 1890–95). See also a sketch of the *Shāhnāmah* in Reed's *Persian Literature* (1893).

Fire. Travellers have frequently affirmed that races have been met with who were ignorant of fire and its uses; but such is very improbable, and the evidence is inconclusive. From the earliest ages man has been able to originate fire, and with its aid to cook his food. The difficulty of starting the flame would, to the savage, be great, and consequently the desire of never allowing it to become extinguished gave rise to the maintaining of special fires under a professional class, which soon became the mysterious and sacred fires of the temples.

Early methods of producing fire are based, in a variety of ways, on the application of friction, as in the rubbing together of two pieces of wood, or of concussion, as in the impact of flint and steel. One of the simplest frictional arrangements is what Mr. Hough calls the fire-plough, a pointed stick run along a groove in a piece of wood lying on the ground. Many improvements upon this method have been found—*e.g.* the bow-drill of the Eskimo, and the pump-drill of the Iroquois Indians. (See Hough's *The Methods of Fire-making*, Report of the U. S. National Museum, 1890). The use of flint and steel may have developed at a very early period; certainly its origin is lost in antiquity. Human culture may be said to have begun with fire, of which the uses increased in the same ratio as culture itself. From the primitive beginnings of the camp fire have evolved the majority of the arts that have supplied man's artificial wants—those primary arts represented by lighting, cooking, offence and defence, and those secondary arts connected with the mechanics of fire or its use in agriculture, timbering, shipbuilding, metallurgy, ceramics, etc. There is also a social history of fire, a mythology which includes the various phases of fire-worship with its ceremonies and observances, and a folklore of magnitude and surpassing interest. See also articles under BELTANE, ORDEAL, PARSEES, and ZOROASTER. For the physics and chemistry of fire, see COMBUSTION, FLAME, and FUELS.

Fire Alarms. See ELECTRIC BELLS AND ALARMS.

Firearms. Buckle says that cannon were used in war before the middle of the 14th century, and in a MS. belonging to Christ Church, Oxford, dated 1326, there is a picture of a cannon (a round-bellied flask) fired by gunpowder. Green, the historian, in describing the battle of Cressy (1346), speaks of the bowmen as 'drawn up in the form of a harrow,' with small bombards between them, 'which, with fire, threw little iron balls to frighten the horses.' These bombards were wider at the mouth than at the chamber, and made of iron bars hooped together with iron rings; some were fashioned out of wood lashed round with rope or wire; others were constructed of leather. In the course of a century various improvements were effected, and Louis XI. of France, in his Flemish campaign (1477), is said to have used 'bombards of great length and power, some with stone balls and some with iron.'

In 1537 the Honorable Artillery Company was incorporated. Firearms were fiercely denounced by Bayard, and by Blaise de Montluc, marshel of France, at the

beginning of the sixteenth century. The English master of the ordnance, in 1544, had under him an artillery train of nearly 500 men.

The cannon of this period were made of cast iron, of bronze, and of brass. The term *culverin* was applied to guns of unusual length which carried iron balls weighing 18 lbs.; while the name *mortar* was given to the short-chambered pieces used for throwing stone balls at high angles of elevation. Dutch artillerists invented the howitzer, a short gun mounted upon a field carriage. A six-inch or ten-inch howitzer was so called from the diameter of the bore, whereas other cannon were distinguished by the weight of their projectiles—*e.g.*, a cannon royal, or 48-pounder; a demi-culverin, or 9-pounder; a serpentine, or 4-pounder. At Malplaquet (1709) a 'triple-bore' gun 4 feet long was taken from the French; it was highly ornamented, and had three vents, one for each bore. In 1799 a short cannon of large calibre was invented at the Carron ironworks in Scotland for use as a naval gun—hence the term *carronade*. In 1747 the French discovered that the fuse of the shell could be ignited on discharge by omitting the tamping around the shell, which expedited loading and increased the safety of fire.

In the early part of the nineteenth century the *columbiad*, a gun adapted for firing both solid shot and shell at low angles, was invented in the United States by Colonel Bomford. This type of gun prevailed until 1859, when General Rodman, of the U. S. Ordnance Department, by his inventions—a perforated cake powder and a new system of casting—revolutionized the making of heavy ordnance.

Breech-loading devices were first used about 1500, and then for small guns only, each gun having several detachable chambers. In 1745 a type was introduced which loaded from a door in the side of the solid breech. The subsequent creations of Krupp, Armstrong, Palliser, and Whitworth belong to the modern history of firearms. The first Krupp gun—68-pounder made of cast steel—on being proved at Woolwich in November, 1855, burst. In June, 1857, six breech-loaders made in New York, each weighing 17 tons, were delivered at Woolwich Arsenal.

Small Arms.—The first invented firearm for infantry was the *arquebus*. It was supported on a rest while being fired. It has been described as having a match or fuse fixed in cock, and fired by a trigger pulling it down to ignite the priming in the pan. It took a quarter of an hour to charge and fire one. These arquebuses, matchlocks, or muskets (as they are variously termed) are first mentioned in 1471, and passed through a variety of forms culminating in the wheel-lock about 1515.

The flintlock was a Spanish invention of the early sixteenth century; it followed the wheel-lock, and its principal advantage was the more simple method of lighting the priming in the pan. The *fusil* (from which *'fusilier'* regiments) was a lighter variety of flintlock, and Marshal Vauban invented a fusil which had a small match fixed to the breech, to ignite the powder in case the flint failed to strike fire. In the course of another hundred years the weapon had undergone further improvements (a musket with a 'motion' for throwing the grenade exists dated 1744), so that in 1776 an infantry soldier was able to load and fire 15 times in 3 minutes 45 seconds.

The flintlock remained in use until the middle of the nineteenth century, the various forms being classed as carbines, rifles, muskets, and fusils. A seven-barrelled flint carbine was produced in 1780; a flint carbine, 'breech-loading,' in 1786. In 1844 the British infantry was armed partly with the old flintlocks and partly with 'the new pattern percussion arm.' The next decade brought forth the Prussian needle-gun, or breech-loader, by the aid of which 20,000 Austrians were in twenty minutes repulsed with a loss of 279 officers, 10,000 men, and 23 field-guns. This occurred in 1866, and all modern armies were soon supplied with small arms of similar pattern.

Pistols have always been used as a cavalry firearm: a specimen dated 1625 exists at the ordnance office in Dublin. During the civil war in England a cuirassier was armed with a sword and 'two cases of good firelock pistols,' a harquebusier bore a harquebuse or carbine with a barrel 2½ feet long, and a dragoon carried a short musket. The revolver was invented in the seventeenth century, but the renowned 'Colt' variety was not evolved until 1835.

For account of the various firearms, see Artillery; Guns; Revolvers; Rifle.

Consult H. B. Pollard, *A History of Firearms* (1926); G. Burrard, *The Identification of Firearms and Forensic Ballistics* (1934); R. E. Gardner, *Arms Fabricators, Ancient and Modern* (1934).

Fireball, a kind of military firework formerly in use. It was thrown from a mortar to light up the position of an enemy. It was a canvas sack smeared with resin, pitch, etc., strengthened by iron and network, and filled with niter, sulphur, and antimony sulphide. For modern practice, see Rockets; Ammunition.

Fire Boat. See Fire Department.

Fire-bote, the right of a tenant, according to English law, to cut wood on the estate for the purpose of fuel.

Firebrick, a substance used for lining flues, furnaces, ovens, retorts, and converters. In metallurgical operations it is made most generally of fireclay (q. v.); but for special purposes of silica, magnesite, bauxite, or chrome iron ore. Steel plants commonly use chrome or magnesite brick, while silica brick, fixed with lime, is growing in favor for coke ovens and metallurgical furnaces. See Brick.

Fireclays are clays which fuse with difficulty when exposed to very high temperatures, and are valuable in consequence for making firebrick (q.v.). A satisfactory fireclay is easily moulded and made into bricks and similar articles. It is composed chiefly of silica and alumina, with a small percentage of iron oxide, and sometimes a trace of potash, soda, or other alkali. A highly siliceous fireclay known as Kieselguhr (q.v.), containing little alumina, has been found to make satisfactory firebrick; and Dinas clay, composed chiefly of silica, makes one of the most infusible bricks known. Underclays, or old soils which are often found below seams of coal, make good fireclays, having been deprived of their alkalis by the rapid growth of the vegetable matter out of which the coal was formed. New Jersey, Missouri, Pennsylvania, and Ohio furnish the fireclays most used in America.

Fire Crest, a bird. See Golden-Crested Wren.

Firedamp. See Methane; Mining Disasters.

Fire Department, an organization composed of either volunteer or paid workers in a community for the purpose of preventing fires, extinguishing uncontrolled fires, and protecting property from damage by water used at fires. Fire Departments vary in numerical strength from a few volunteers forming a bucket brigade, or with a small apparatus carrying buckets, fire extinguishers, hose, ladders, hooks and axes, to a fully paid group of well-organized firemen equipped with modern fire apparatus, such as that of the City of New York, which has the largest fire department in the world. Some volunteer departments own their own equipment and are supported by funds raised by holding bazaars and other forms of entertainment. Most volunteer departments are supported by the community which they serve, but the members serve without compen-

Fire Department

sation. Paid fire departments, such as those of the City of New York and other large cities, are completely supported by their communities.

Fire departments and practice in Canada are of the same general character as those in the United States. In the larger cities and the more important commercial centers, 'full-paid' fire departments are the rule. The members devote their entire time to the fire service and receive regular compensation, while all apparatus and property are owned by the community, and all expenses of maintenance are borne by it. Fire stations, in which the apparatus and equipment are protected, also provide comfortable sleeping quarters for the members. Many of these stations have gymnasiums, hand-ball courts and libraries. The members of most of these departments operate under a two-platoon system, in which one half of them is on duty while the other half is off duty. The system of platoons vary; in some departments the members are on duty for 24 hours and then off duty 24 hours; in other departments, the members alternate between day shifts of 9 or 10 hours and night shifts of 14 or 15 hours. Most departments have systems which provide for the recall of members off duty in the event of a large fire, during heavy snow storms or other emergencies.

In most of the moderately sized cities, the Fire Department is under the control of a Commissioner of Public Safety, appointed by the Mayor and the City Council. The Commissioner of Public Safety, in addition to his jurisdiction over the Fire Department, usually exercises control over the Police Department, Sanitation Department and Health Department. Fire departments in the larger cities are under the control of a Fire Commissioner who directs the administrative affairs of the department, and the work of the civilian members.

The fire-fighting or uniformed force is generally under the direct supervision of the Chief of Department, who, in most cases, is appointed after being subjected to a competitive civil service examination. The 'full-paid' department is undoubtedly the most efficient for larger cities, resulting not only in the saving of life at fires, but in reduced fire losses, and consequently in lower insurance rates through which communities are well compensated for the money spent in the support of such departments.

Another form of the Fire Department is that in which some of the members are 'full-paid,' while the remainder are designated as 'call-men.' The 'call-men' receive salaries varying from 10% to 25% of that of the paid men; their daily employment must leave them free to respond to fires in their districts during the day time, and must leave them conveniently located; during the night time they sleep in the fire stations as do the paid members. In some departments, the 'call-men' are required to respond to all fires, being fined for missing any, while in other departments, they are allowed to miss a certain percentage without fine and without detriment to their standing. The 'call-men' are usually young men who have ambitions of becoming regular firemen, and who are so appointed when vacancies occur in the ranks of the regulars.

Another class of Fire Department has full-paid men, call-men and volunteers. Some have but a few paid members, such as officers, pump operators, and chauffeurs, who bring the apparatus to fires, and then depend on the call-men and volunteers to stretch hose lines and perform such other fire service duties as may be required of them. In some places only the chauffeurs are full-paid, the rest of the members being volunteers. And in some cities there are both volunteer and full-paid companies; the former in many cases own their own apparatus and quarters which are purchased, maintained and serviced from fixed yearly sums allotted to them by the city.

Fire departments organized on the volunteer basis are by far the most numerous. Some of these departments own all of the fire apparatus, houses, outfit, and operate without cost to the taxpayers, being supported by the dues and fines of members, by donations, and by the proceeds from entertainments. The system of dues and fines, which was much in vogue some years ago, has now, however, almost entirely disappeared. In other places, the apparatus is owned by the public, who pay the cost of maintenance. Social organizations, supported by the members, are usually a feature of such departments. In some communities the firemen receive a set sum per year from the town or village; in others the authorities grant a small sum to the firemen for every fire attended.

The largest volunteer fire department in the United States is that of Reading, Pa. (population 113,249). There are 6,259 active volunteer members including the company officers, and 63 full-paid members, as follows: 1 chief, 2 assistant chiefs, and 60 chauffeurs. The apparatus is owned by the city, and the membership is represented, in its dealings with the city, by a 'Firemen's Union.' The equipment comprises 28 pieces of fire apparatus which include: two 1000-gallon gasoline-propelled pumping engines, fifteen 750-gallon gasoline-propelled pumping engines, three 500-gallon gasoline-propelled pumping engines, one chemical engine with booster tank, three aerial hook and ladder trucks, one emergency truck, and three chief's cars. The value of the equipment is $200,000; the value of the department buildings is $225,000; the budget allowance for 1938, paid by the city, was $136,520.

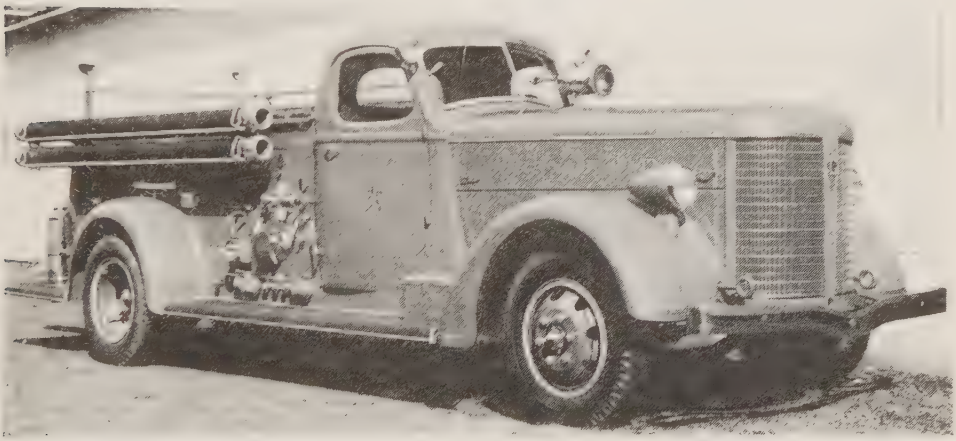
There are a large number of places having 1,000 or more population which have no organized fire protection whatever; and there are places fairly large, as well as many smaller ones, having good mutual fire protection societies, which may be the only fire forces in the community, or may operate as auxiliary to the public fire departments.

These home fire protection associations enroll those persons who will agree to serve at fires, within a given district of say half a mile from their homes or places of business. Each member of the association pays into a common treasury an annual fee, and provides a pail, pump, and short coil of suitable hose, portable chemical extinguisher, axe, rope, short ladder, torch, or some other fire-fighting appliance, which may be kept at home or other suitable place. Light running wagons, to be drawn by hand ropes or horses, with ladders suitable for the section covered; ropes, hooks, chemical extinguishers, axes, buckets, oilcloth covers to protect goods, pianos, furniture, or other valuables, and other things useful in this form of fire service, are located at convenient points.

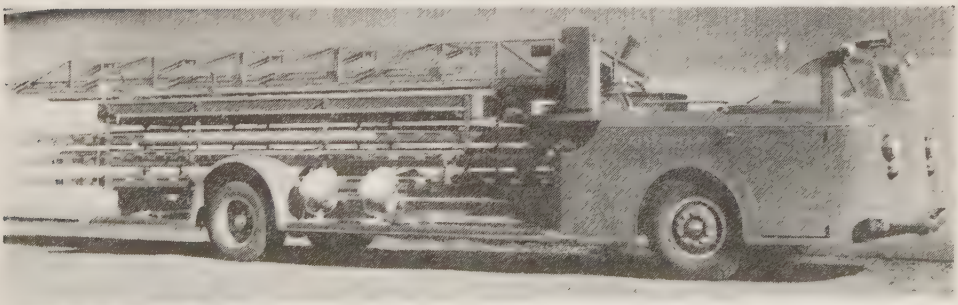
In addition to the public fire departments there are throughout the country many first-class private fire departments, supported by industrial organizations and institutions, the equipment of which is of the most approved and effective character. Many large plants are fitted to attack fire within the danger zone of their own premises. Some railroad companies have equipped their yard engines with pumps for use at their own and contiguous fires, and many harbor tugs and steamboats are prompt to assist, in so far as they can, the work of the fire departments.

Fire departments, both paid and volunteer, in the different communities within the same counties of the various States, have combined in what is commonly called 'The Plan.' The

SEMI-TRAILER UNIT EQUIPPED WITH POWERFUL FLOODLIGHTS FOR NIGHT WORK



PUMPING ENGINE FOR LIGHT CITY DUTY AND RURAL SERVICE



Photos Courtesy American-La France-Foamite Corp.

CAB-OVER-ENGINE TRUCK WITH HYDRAULICALLY OPERATED AERIAL LADDER

Fire Department

purpose of this is to have the companies from the various communities assist the companies of nearby communities, in the event of a large fire. This assistance is often rendered by a fire company from another community 'locating' in the fire station of its neighboring company while the latter is engaged in fighting particularly difficult fires. This 'locating' is done in preparation for response to any alarm in the district normally protected by the absent company. A fixed code of signals has been arranged in many counties, which hastens this assistance. 'The Plan' is a very progressive step in fire protection's science.

New York City Fire Department.—Making allowances for local conditions and differences in population, the organization of the New York City Fire Department may be taken as fairly representative of those of other large American and Canadian cities. Its membership on Dec. 31, 1939, when the three-platoon system was completely installed, consisted of 11,297 uniformed members, 799 civilian employees and 64 volunteers, a total of 12,160 members. It has 361 full-paid companies and 2 volunteer companies. The apparatus, which is entirely motorized, consists of: 280 pumping engines, 135 hose wagons, 166 aerial ladder trucks, 10 fireboats, 9 water towers, 5 rescue trucks, 4 searchlight engines, 3 gasoline fuel supply trucks, 14 mobile fire-hydrant thawing trucks, 2 ambulances, 1 smoke ejector and foam truck, 156 chief's cars, 2 wrecking trucks, a total of 787 pieces of apparatus.

The New York City Fire Department protects a population of 7,500,000 and a property valuation of $16,559,695,194. The area protected comprises 318 square miles with a water front of 578 miles.

The head of the New York Fire Department is the Fire Chief and Commissioner, appointed by the Mayor. This position was created by Mayor La Guardia in 1934, and he immediately appointed John J. McElligott, then Chief of Department, to the position which includes the duties both of Fire Commissioner and of Chief of Department. The Fire Chief and Commissioner receives an annual salary of $15,000. The salary of Chief of Department is $12,500 which is not paid while the Chief of Department is serving as Commissioner.

The quota of the uniformed force of the department on December 31, 1939 when the installation of the three-platoon system was completed was: 1 Chief of Department at $12,500; 3 Assistant Chiefs of Department, 5 Deputy Chiefs in Charge of Boroughs, 47 Deputy Chiefs of Department, 160 Battalion Chiefs, 365 Captains, 1,132 Lieutenants, 9,444 Firemen, 1 Chief Medical Officer with the rank of Deputy Chief, 15 Medical Officers with the rank of Battalion Chief, 5 Chaplains with the rank of Battalion Chief and 1 Fire Marshal.

All members of the uniformed force—those attending fires—enter the department under civil service rules, serving three months on probation. During this period, they attend the Probationary Firemen's School and are drilled and instructed for 60 days. The instruction consists of wall scaling with pompier ladders, life net jumping, use of tools and equipment, and other activities which tend to qualify them for the strenuous duties of firemen. If the probationer proves that he is qualified, he is appointed a Fourth Grade Fireman at $2,000 for one year, after which he is advanced to the Third Grade for the succeeding year, at the same salary; the third year he is advanced to the Second Grade at $2,500, and the fourth year he becomes First Grade at $3,000 per annum.

Promotions thereafter are by competitive Civil Service Examinations for Engineer of Steamer, Pilot, Lieutenant, Captain, Battalion Chief, Deputy Chief of Department, and Chief of Department. Assistant Chiefs of Department, and Deputy Chiefs in Charge of Boroughs are selected from those holding the rank of Deputy Chief of Department.

All members of the uniformed force, with the exception of the Chief of Department, operate under a three-platoon system, that is: they are on duty not more than eight hours in any one day. The force is divided into ten groups and each group starts performing duty at different periods; for example, Group #1 performs duty from 8 A.M. to 4 P.M. for six days, and after being off duty for thirty-two hours, the group returns to perform duty from 4 P.M. to midnight for six more days; the other nine groups perform duty in the same manner, except that they start their periods of duty at different times, thereby creating a stagger system.

The Medical Officers look after the sanitary conditions of the fire stations and the general health of the members. Sick leaves are granted to members after the applicant is examined by the medical staff. Members may be retired for disability, and also may retire on their own application at any time after they have been in the service for twenty years, on a pension of not less than one-half of their salary at the time of retirement.

The New York Fire Department has developed an extensive system for the training of its officers and firemen. It has established a Fire College which consists of the following schools: the Officers' School for training officers; the Motor and Pump Operators' School for training members who drive apparatus and operate pumps; the Fire Hazards Inspectors' School for training the uniformed members who inspect buildings to discover and correct fire hazards; the Fire Protection Field Educational School for training firemen in public speaking and lecturing; the Company School for testing the efficiency of the complete personnel of each Fire Company; the Probationary Firemen's School for training recruits.

Fire-fighting Apparatus.—This includes chiefly fire engines, hook and ladder trucks, water towers, chemical engines, fire boats, hose, fire alarm telegraph system, high pressure water systems, standpipes and automatic sprinkler systems.

Fire Engines.—As commonly understood, a fire engine is a mobile pumping apparatus designed to discharge hose streams on fires. Steam fire engines are now obsolete. Gasoline-motor propelled fire engines, arranged so that the motor which propels the apparatus to a fire is also used to propel the pumps which generate pressure to discharge high pressure hose streams. The most practical type of pumping engine is a six-cylinder motor with 120 horse-power; such a pump can discharge 1,000 gallons of water per minute at 120 pounds pressure. In addition, this type of apparatus usually carries 1,200 feet of 2½-inch hose, various types of hand-operated chemical extinguishers, and numerous kinds of nozzles and other fire-extinguishing tools.

Aerial Ladders.—The longest aerial ladder extends to 85 feet. Such a ladder can be raised for fire work in half a minute, and this has been accomplished in 19 seconds. A chain of pompier or scaling ladders can be run up and secured into eight stories of windows in 45 seconds. This remarkable feat has been made possible by a combination of compressed coil springs and hydraulic (oil) power under a pressure of 7,000 pounds to the square inch. The lowering of the ladder compresses the spring that helps to raise it again. The ladder is superimposed on a geared

Fire Department

ball-bearing turntable, by which it can be turned and inclined in any direction, after being raised to a perpendicular position. If necessary, the raising, turning, and lowering of these aerial ladders may be done by one man. The ladders are carried on trucks, along with the other necessary implements, such as axes, hooks, and canvas life-net.

Water Towers.—In some cases in which it is essential to pour large streams of water into upper stories, it is impractical or dangerous to do so from ladders or deluge pipes. In such cases, water towers are used. These towers are constructed to discharge up to a 2-inch stream, and from a point as high as 75 feet above the ground. A steel I-beam frame supports a working platform, which carries the tower and accompanying appliances. When housed, the tower, telescoped into itself, lies horizontal, and is about one half of its perpendicular height when fully extended. In some forms the discharge end of the tower trails out behind, and in others it extends out in front of the truck. The lower section of the tower is made of four heavy longitudinal angle irons connected up, tapering and square, by open plate or lattice work, the lower end being sufficiently large to give stability, and being connected to the platform and fitted for raising as are the aerial ladders. Some of them are raised by hydraulic power derived from fire engine or hydrant pressure. The water-service pipe of the tower is of 5-inch smooth bore steel tubing, housed within the lower open-work tower section, its upper end projecting and surmounted by an adjustable play pipe with its operating mechanism.

To the bottom end of this upper or tube section there is securely attached an end of a section of 4-inch fire hose, the other end of which is attached to a boiler-plate water chamber secured on the truck framework. This chamber has a number of hose connections, and to those connections are attached as many engine or hydrant streams as may be required to furnish the volume of water desired through the water tower. The tubular section is projected from the lower section by means of a double non-rusting cable, drum wound and worked by hand, carrying up with it the attached end of the 4-inch supply hose. The nozzle may be so raised or lowered, and turned to the right or left, by cables and gearing operated by a fireman standing on the platform, as to deliver the stream at any given point. The modern water tower is now generally driven by some form of motor tractor.

Fire-alarm Equipment.—Most cities are equipped with a Fire-alarm System which is electrically controlled, and is generally owned and maintained by the city. It is called a Bureau or Division of the Fire Department. Without such a system, the Fire Department would be unable to function with any degree of efficiency; for it is this Bureau which receives and transmits all alarms of fire to the fire-fighting force.

In New York City there are 10,718 fire-alarm boxes in service, connected by 19,993 miles of underground cable and 1,713 miles of wire attached to overhead-pole lines. There are five central stations, one in each borough. These are connected with 361 fire companies, and with numerous Fire Department offices at which fire-alarm service is maintained.

The circuits to which these boxes are attached are arranged in such a manner that it would be almost impossible to send in an alarm from the same locality on two boxes of the same circuit. The system is so sensitive that trouble of any sort is quickly registered at the central office, and its location is recorded with a fair degree of accuracy.

Alarms of fire are transmitted from the street boxes to the central station from which they are relayed to all the fire companies in a given borough. The signal dispatcher may, however, select a circuit or circuits for relaying and transmitting the alarm to a certain group of fire stations. Independent circuits are provided for notifying the Chief of Department, Fire Boats and Fire Patrols. Public Schools and other public buildings are equipped with fire-alarm boxes so that no delay will be experienced in summoning help in the event of fire.

New York City has a two-way radio system, for use in the event of fire. It is connected with the Fire Boat Fleet, Rescue Apparatus and to the cars of the high-ranking Chief Officers.

Fire Boats are a sort of marine fire engine moored along the water front of harbors and rivers of cities where the danger from fire in large vessels, piers, warehouses, lumber yards, etc., is great. The prime features of an efficient fire boat are speed, ease of maneuver, powerful pumps for the discharge of high pressure hose streams and low draught to enable them to operate at low tides in streams, etc.

The majority of fire boats are steam propelled and are equipped with steam-driven centrifugal pumps capable of discharging 11,000 gallons of water per minute at 150 pounds pump pressure.

The Fire Boat *John J. Harvey*, the latest addition to the fleet of 10 fire boats in New York City, is propelled by five 550 horsepower gasoline engines and can develop a speed of 18 miles per hour. When in action at a fire, four of these engines are switched to the pumps to discharge water. At 150 pounds pump pressure, these pumps can discharge 16,000 gallons of water per minute through 32 nozzles. The remaining engine is used to generate power to maneuver the boat.

The *Harvey* is used to supplement the water supply in the Coney Island high pressure system; this is done by connection to special hydrants at the Coney Island pier.

Most fire boats have monitor or turret nozzles, connected directly with the pumps. The *Harvey* has eight such nozzles; one in the bow, called the bow-gun, can discharge 3,000 gallons of water per minute; on the fire-fighting mast or tower, aft, there are three turret pipes.

The decks of modern fire boats are constructed of metal, and the entire hull and superstructure are protected by water curtains while the boat is in action.

In addition to the turret pipes, modern fire boats carry large quantities of 3½- and 2½-inch hose for use in reaching fires on land, and a large assortment of pipes, nozzles and fittings for use in the quick extinguishment of fires.

While in the station, pilots of fire boats, marine engineers and stokers stand regular watches on board, and sleep on the boat, while the regular fire-fighting force is comfortably housed ashore. On steam-propelled boats, a pressure of 200 pounds is generally maintained, so that response to alarms can be made quickly. Upon receipt of an alarm, the fire-fighting force casts off the hawsers and disconnects the electric-light lines and fresh water connections with the shore, while the engine-room crew closes and seals the hatches, and starts the machinery to give forced draught to the fires and to provide fresh air to the various compartments, after which the boat slips out into the stream under the supervision of the pilot.

The marine engineers and pilots of the boat carry United States marine licenses, and they and all members of the crew except the stokers are members of the uniformed force.

At fires close to the water front, where the boats cannot operate directly on the fire, the crews stretch hose lines to a distance of as much as 2,000 feet

Fire Department

and operate in the same manner as members of land companies.

The New York Fire Department's marine fleet is now equipped with its own two-way radio system. Through Station WNYF, direct communication is now possible between any or all of the boats, between the boats and the Central Telegraph Station, and between the Fire Chief and Commissioner and any of the boats. The system makes it possible for the Fire Chief and Commissioner, from his office in the Municipal Building, or from his night quarters in Great Jones Street, to direct the operations of the fire boat fleet at a fire at any place in New York Harbor.

Chemical Fire Engines.—The chemical fire engine is a valuable adjunct to fire department equipment, and is steadily increasing in favor with fire engineers. These engines are mounted on either two or four wheels; have two or more copper chemical tanks, of 30 to 100 gallons capacity, are propelled by motor and carry up to 500 feet of one-inch chemical hose.

The tanks, which may be either horizontal or perpendicular, are filled with fresh water into which a given quantity of bicarbonate of soda has been dissolved. A given quantity of sulphuric acid is also sealed in a lead or glass container and placed in the water tank, the charging cap of which is then screwed tight. A contrivance, operated from the outside, either breaks the glass acid container or upsets the lead one, bringing the acid and soda water together, causing chemical reaction, and liberating carbonic acid gas. Pressure is thus developed to eject the gas-impregnated water upon the fire, where the carbonic acid gas is liberated, thus excluding air and assisting the water to extinguish the fire.

Another system injects carbon binoxide and anhydrous ammonia into the water, the apparatus being tested up to 4,000 pounds per square inch. The solution gives off carbonic acid and free ammonia gases, in contact with which flame cannot exist. Still another system injects a chemical powder into the hose streams from engines or hydrants, chemicalizing the water and liberating carbonic acid gas in the presence of the fire with the same results as the other 'chemicals.'

Nearly every fire department in the country has one or more chemical outfits. The one most generally used is known as the 'combination wagon,' and carries one or more chemical tanks and a complement of hose, ladders, and other light fire appliances. 'Chemicals' are extensively used also in sections where water is not available, and it is estimated that they extinguish from 50 to 75 per cent of the small and outlying fires they attend.

Automobile Fire Apparatus.—Motor-propelled and operated fire apparatus have been greatly improved in recent years. The types are numerous. Similar alterations have been made for hook and ladder trucks, aerial ladders, and water towers. Another type of apparatus is propelled by a gasolene engine connected direct to the running gear. After the run to the fire has been made, the gasolene engine is connected direct to the pumps for fire service. In another type a gasolene engine drives an electric generator, which supplies current to motors attached direct to wheels or running gear, or to pumps or gearing for raising ladders or water towers. This method is also used for propelling hose wagons, chemical and combination outfits, etc. In some horse-drawn fire engines the pumps are operated by gasolene engines. The city of Savannah, Ga., was the first city in the United States to discard all horse-drawn equipment and substitute a complete motor-driven outfit. Several other cities are now completely motorized in their fire departments, the largest of them being Toledo, Ohio.

In New York City, the replacing of horse-drawn fire apparatus was begun in 1911, and in 1924 the last horse-drawn company was motorized.

High-Pressure Systems.—The best water system for fire protection and fire fighting in large cities is that known as the 'high pressure' system, installed with the view of fire service only, since the ordinary domestic water-supply systems seldom carry pressures beyond 75 pounds—a pressure too light to meet the requirements of present-day fire-fighting. Where the water supply is free and abundant; the head sufficiently high to give the necessary hydrostatic pressure; the mains and distribution pipes so sized, laid, and connected as to allow a maximum free gravity water flow to easy working hydrants of large caliber and free delivery; so spaced as to require but short fire hose lines, the high-pressure system is not only the best, but the most economical to maintain.

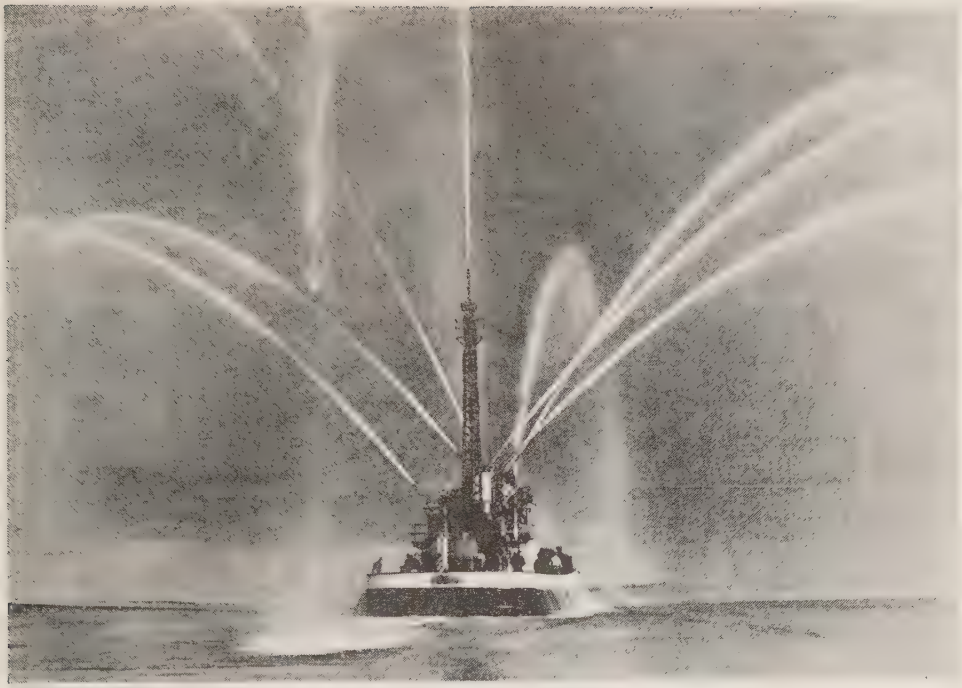
Where stationary pumps are employed to force the water into the distributing system, and where the necessary high water pressure is continuously maintained or the machinery held in readiness to furnish it instantly when required, there is an added expense. Still, the cost is less than for the maintenance of a sufficient number of steam fire engines for an equal fire service, and the system is specially desirable by reason of its immediate availability, continuous supply, steady pressure, and the readiness with which it can be increased to its maximum pressure, giving fire streams of great volume and penetration.

In the Great Lakes cities—Buffalo, N. Y., Cleveland, O., Detroit, Mich., and Milwaukee, Wis.—and in some of the seaboard cities, there have been for some years systems of fire pipe lines independent of the domestic water-supply systems, which are used solely for fire purposes. These lines are supplied from fire-boat pumps to which they are connected by hose at the waterfront, the boats being moved to any of the numerous pipe lines leading inland from the waterfront, as required. The time lost in bringing the boats to the point of use and then developing the maximum pressure precludes this system from being classed with the modern systems designated as 'high-pressure fire service.'

The New York City high-pressure fire system is the largest in America. Each pumping station has an allotted distributing territory, but they can be thrown together or separated by means of electrically worked gate-valves operated from the main pumping station. All fire alarms in the high-pressure zone are received in the pumping stations, whereupon the pumps are instantly started.

England.—Throughout the country there are nearly one hundred full-time professional fire brigades, of which 35 draw their personnel from the police forces of the cities concerned; the others are recruited from men of the royal navy and the merchant marine. There are, in addition, numerous brigades of which the personnel is on a part-time basis (with pay) and others manned entirely by volunteers; private corporations in many instances have their own fire brigades.

In London, besides the London Fire Brigade, which services London County and the City of London, there are distinct professional brigades in ten of the suburbs. The area covered by the London Fire Brigade is controlled from headquarters in Southwark, fire appliances being moved from one to another of the six districts as occasion may demand. The cost of the fire services amounts to $700 annually per each 1,000 of the population, and $60 for each $5,000 of rateable value. No charge is made to owners of property for the services of the fire brigade, except in cases of chimney fires



Westinghouse Photo

A FIRE-BOAT DEMONSTRATING ITS FIRE-FIGHTING EFFECTIVENESS WITH POWERFUL STREAMS OF WATER

Courtesy American-La France-Foamite Corp.

THE MOBILE FIRE-TOWER IS A MODERN FIRE-FIGHTING DEVICE

(always the result of neglect), when the charge varies from sixty cents to five dollars and is enforceable in the courts.

With replacement of horse-drawn vehicles by motor-driven apparatus, the number of station houses in London was reduced by 25 per cent; modern equipment includes fire floats on the river Thames, smoke helmets and 82-foot turntable ladders.

Historical.—Fire-extinguishing machines have been used from an early period. The Romans, in the time of Trajan, are said to have used 'leathern bags with metal pipes attached.' These were filled with water, which was projected through the outlet pipe by pressing the sides of the bag. Hero of Alexandria, in 150 B.C., describes a siphon for use in conflagrations. During the sixteenth and seventeenth centuries large metal squirts were used in Britain and in Germany for extinguishing fire.

The fire engine which formed the basis upon which the more modern manual engine was built was introduced by Van der Heide, a Dutch engineer, who in 1670 made an engine and flexible leather hose; but as early as 1650 it is recorded that James Colquhoun of Edinburgh built an engine for that city and another for the city of Glasgow. Newsham of London built the first successful engine in England in 1721, which was adopted by the principal cities of England and America. The first steam fire engine was built in 1829 in England, and shortly afterward experimental machines were developed in the United States—Cincinnati, where the Latta engine was constructed about 1850, enjoying the distinction of having the first department regularly equipped with steam fire engines. This system was soon followed throughout the larger cities of the United States, and already in the early seventies an attempt was made to use steam-propelled fire engines. The present fire department of New York City was organized on May 25, 1865.

Consult *Annual Reports* of Fire Departments of individual cities; Fire Departments of the United States, 700 cities and towns (Municipal Journal, N. Y., vol. xxxi); *Handbook* of the London County Council, *London Fire Brigade* (1925); Report No. 5 on the New York City Fire Department by National Board of Fire Underwriters (1929); Costello, *Our Firemen, history of the New York Fire Department*; E. W. Williams, *Encyclopedia of Fire Control* (1926) and *Fire Fighting* (1936); Crosby-Fiske-Forster, *Handbook of Fire Protection* (1935).

Fire Disasters. The first important fire of which we have authentic record is that of Rome (65 A.D.). The Christians have been accused of starting this fire by way of revenge for persecutions; while the Emperor Nero himself, who, it was said, was anxious to get rid of some unsightly corners of old Rome, is held responsible by many. It is known, at any rate, that the emperor was slow to take effective measures for the city's protection. The fire, starting in the Circus Maximus, spread without much opposition until it was beyond control; lasted for eight days, and destroyed the greater part of the city.

The Great Fire of London, of which a full and vivid account is contained in Pepys' *Diary*, occurred in 1666. Early in the morning of Sunday, Sept. 2, it started from an unknown cause in a bakeshop in Pudding Lane, and raged for six days. The burnt area amounted to 436 acres, and included 400 streets and lanes, 13,200 houses, 86 churches, besides St. Paul's Cathedral, Newgate and Fleet prisons, and three of the city gates. There was little loss of life; the property loss has been estimated at $60,000,000. Unfounded contemporary rumors attributed the origin of the fire to Roman Catholic incendiaries; and the commemorative Monument was inscribed to that effect until 1830.

The great Moscow fire of 1812 was started by Russian incendiaries after the occupation of the city by Napoleon's army. The army and the inhabitants deserted the city on Napoleon's approach, taking with them the fire engines, and leaving in the houses quantities of combustible material. The fire, starting simultaneously in several parts of the city, raged for seven days, with little opposition from the disorganized French troops. The loss was about 31,000 buildings and $150,000,000.

Hamburg was the next city of the Old World to suffer greatly from fire, with a loss in 1842 of 1,992 houses and $35,000,000. The Constantinople conflagration of 1848 resulted in a loss of 3,000 shops and houses and $15,000,000; and that of 1870 in a loss of 7,000 buildings and $25,000,000. At Antwerp, in 1901, the destruction of the royal bonded warehouses caused a loss estimated at $25,000,000.

Within the last century, many of the larger cities of America have been partially destroyed by fire. The business section of New York was practically wiped out in 1835, with a loss of $15,000,000, by a fire starting in a narrow, gale-swept street. Ten years later, partly in the same district, a $7,500,000 loss was sustained, and a number of people were killed by explosions of stored gunpowder.

Philadelphia has been visited by several fires noteworthy for the special conditions causing large loss of life. In 1850 fire in a congested district, accompanied with explosions, caused the death of 39 persons, injured 100 others, and burned 400 buildings. In 1865 a blaze starting among several thousand barrels of coal oil liberated the burning oil in the streets, and 20 persons lost their lives. In the following year, Portland, Me., suffered a $10,000,000 fire from the explosion of a firecracker among wood shavings, combined with the rapid spread of the flames by a gale. The business portion of the city was destroyed.

The great Chicago fire of 1871 is said to have started from the upsetting of a kerosene lamp. Drought and a high wind furnished favorable conditions, which, with the burning of the water-works, caused the flames to sweep over 2,124 acres. About 200 lives were lost, and nearly 100,000 people were rendered homeless. Supplies of food, clothing, and money were sent to the relief of the city. The loss was estimated at from $106,000,000 to $165,000,000.

A year later, a fire of unknown origin, starting in a wholesale drygoods house, found Boston with an insufficient water supply and horses disabled by distemper. Sixty-five acres were burned, with a loss of about a dozen lives and $75,000,000.

The Hoboken pier and steamer fire of 1900 cost 215 lives and $4,627,000. The burning of the steamer *General Slocum* in the East River in 1904 was one of the costliest in human lives recorded, the number of victims being 1,020.

In Baltimore (1904), a gas explosion started a fire which, driven by a gale, in 30 hours spread over 140 acres and destroyed $50,000,000 worth of property, chiefly in the business section. The framework of fireproof buildings met with comparatively slight damage, the destruction of their contents being caused largely by the lack of window protection.

The fire that succeeded the San Francisco earthquake in 1906 started simultaneously in several places, perhaps from crossed electric wires. The water mains had not withstood the earthquake shock, a gale arose, and only a little over 2 per cent of the buildings were fireproof. The result was the laying waste of four square miles,

The Great Fires of History

Date	Place	Loss
65	Rome	
798	London	
982	London	
1106	Venice	
1212	London	
1405	Berlin	
1577	Venice	
1634	Berne	
1666	London	$60,000,000
1680	Berne	
1700	Edinburgh	
1707	Lisbon	
1728	Copenhagen	
1750	Constantinople	15,000,000
1751	Stockholm	
1752	Moscow	
1795	Copenhagen	
1798	Constantinople	
1812	Moscow	150,000,000
1835	New York	15,000,000
1842	Hamburg	35,000,000
1845	Pittsburgh	10,000,000
1845	New York	7,500,000
1846	St. Johns, N. F.	5,000,000
1848	Constantinople	15,000,000
1851	San Francisco	10,000,000
1861	Charleston	10,000,000
1866	Portland	$10,000,000
1870	Constantinople	25,000,000
1871	Chicago	165,000,000
1872	Boston	75,000,000
1874	London	9,250,000
1876	St. Hyacinth, Canada	15,000,000
1877	St. John, N. B.	15,000,000
1882	Kingston, Jamaica	10,000,000
1889	Seattle	6,626,000
1892	St. Johns, N. F.	25,000,000
1896	Guayaquil, Ecuador	22,000,000
1900	Hoboken, N. J.	4,627,000
1900	Ottawa and Hull	15,000,000
1901	Antwerp	25,000,000
1901	Jacksonville, Fla.	10,500,000
1904	Baltimore	50,000,000
1904	Toronto	12,000,000
1906	San Francisco	350,000,000
1908	Chelsea, Mass.	6,000,000
1910	Albany, N. Y.	5,000,000
1911	Brussels Exposition	10,000,000
1911	Constantinople	10,000,000
1914	Salem, Mass.	12,000,000
1916	Jersey City, N. J.	22,000,000
1917	Halifax, N. S.	20,000,000
1923	Tokio—Yokohama, Japan	1,000,000,000
1926	Lake Denmark N. J.	85,000,000

and the loss of about 200 lives and $350,000,000 worth of property. Supplies were freely sent to the sufferers from this, the most disastrous catastrophe of recent times.

There were three disastrous American fires of possibly treacherous origin during or soon after the World War, each following the explosion of munitions. On July 30, 1916, fire broke out at the end of a Lehigh Valley Railroad pier, Black Tom Island, Jersey City, N. J. It spread to a lighter laden with trinitrotoluol which exploded, scattering the fire to adjoining piers. There were only seven lives lost, but the property damage amounted to $22,000,000. The loss of time was felt nearly as keenly as the loss in money, for the facilities of the harbor were considerably dislocated in the trans-shipment of war supplies.

On December 6, 1917 the explosion of a munition ship in the harbor of Halifax, Nova Scotia, caused a fire that laid waste over two square miles of the city. Fifteen hundred people were killed outright, and three times as many seriously injured in the explosion, the fire and the blizzard that followed. The property loss of $20,000,000 included that of shipping in the harbor.

The third explosion occurred at Lake Denmark, N. J., in the U. S. Navy Arsenal which was struck by lightning. Eighty buildings were crushed, ten nearby towns were destroyed, and thirty people killed. The property loss was $85,000,000.

The greatest earthquake disaster in history occurred in Japan in 1923, about noon of September 1, when Tokyo and Yokohama, Nagoya and a score of villages were almost entirely destroyed. During the next three days fire and tidal wave completed the damage which amounted to over one billion dollars. Two hundred thousand people were killed; the resources of the civilized world were called upon to care for the half million injured. Response for reconstruction was immediate and generous, and the cities were rebuilt at once.

A fire in a hospital in Cleveland, May 15, 1929, although not extensive, typified a group of serious fires involving nitrocellulose. In Dr. George Crile's Clinic there was a spontaneous combustion of x-ray films which was responsible for 130 deaths. The following year a disastrous blaze in the Ohio State Penitentiary at Columbus took the lives of more than 300 trapped convicts. In 1934, an $8,000,000 fire seriously damaged the stockyards area in Chicago; a similar conflagration destroyed elevators and grain valued at $4,000,000 in the city's Calumet River district in 1939. Among the most costly water-front fires of the decade were the destruction of the motorship *Lafayette* (1938) and the French liner *Paris* (1939) at Le Havre. The peak of fire losses in the United States was reached in 1922–26; by 1933 national fire losses were cut in half, largely due to fire prevention study and publicity. Despite stressing of periodic inspection and fire hazard elimination, the 1939 U. S. fire loss of $314,000,000 represented a substantial increase over either 1937 or 1938.

Theatre Fires.—The Roman theatres, seating from 15,000 to 250,000 spectators, were provided with so many exits and fireproof staircases that in the various fires recorded there was little known loss of life. In modern theatres, on the other hand,

The Great Theatre Fires of History

Date	Place	Dead
1811	Richmond, Va.	75
1836	St. Petersburg	800
1845	Canton, China	1,670
1846	Quebec	200
1871	Shanghai	120
1872	Trenton, N. J.	600
1876	Brooklyn	283
1881	Nice	70
1881	Vienna	450
1883	Berditscheff, Poland	268
1887	Paris (Opera Comique)	100
1887	Exeter, England	175
1888	Oporto, Portugal	200
1897	Paris (Charity Bazaar)	124
1903	Chicago (Iroquois Th.)	574
1928	Madrid	110
1929	Igolkins, Russia	114

fires have been accompanied by a large mortality, due to failure either in construction or in efficient protective measures. A problem arose in 1928 and 1929 all over the world of the moving-picture theatre, when a number of fires arose from the explosion of decomposed nitrocellulose films. With improvement in construction and storage of film this particular hazard was practically eliminated. Fireproof construction and increased frequency of strict inspection greatly diminished the danger.

Consult Pepys' *Diary;* Goodspeed, *Great Fires of Chicago and the West;* Sachs, *Fires and Public Entertainments;* Norton's 'Conflagration in Baltimore,' in Insurance Engineering Experiment Station's *Report 13* (1904); E. Gilligan, *Death in Halifax, American Mercury,* February, 1938.

Fire Engine. See FIRE DEPARTMENT.

Fire Escape. See FIRE PROTECTION.

Fire Extinguishers are portable appliances designed to provide a small quantity of water or other extinguishing agent to cope with fires in their incipiency. (Ordinary combustion is the chemical combination of some substance with the oxygen of the air.) The action of all types of extinguishers is; (1) by cooling the burning substance to below its ignition temperature, (2) by excluding the air supply, or (3) by a combination of these two methods. With some types, there is also a chemical action tending to inhibit oxidation, referred to as a catalytic action. The hand type of extinguishers are for small fires only, and cannot be expected to be effective when a fire has a large amount of combustible material. It is important, therefore, that extinguishers be readily accessible so that they may be used quickly when a fire starts. It is standard fire protection practice to purchase only extinguishers bearing the label of Underwriters' Laboratories, Inc., or Factory Mutual Laboratories, as this assures reliability, suitability, and safety of the devices. Common types of fire extinguishers range in size from one quart to five gallons and weigh up to 85 pounds. Larger sizes have capacities of 40 gallons or weigh up to 350 pounds, and have wheels so that they may be pulled about.

Each type of fire extinguisher is not equally effective on all kinds of fires. For fires in ordinary combustible materials where the quenching and cooling effects of water (or solutions containing large percentages of water) are of first importance, the following types are most effective: (1) *soda-acid,* in which the reaction of sulphuric acid on a solution of sodium bicarbonate and water produces pressure which expels the liquid from the extinguisher; (2) *pump tank,* which uses plain water or a non-freezing solution and is forced on the flames by a hand pump; (3) *plain water,* which uses a carbon dioxide cartridge to provide pressure for expelling the water; and (4) *calcium chloride,* using an anti-freezing solution expelled by fuse or carbon dioxide cartridges or by an acid reaction. In addition to being useful on ordinary fires, the following types of fire extinguishers are particularly effective on fires in small quantities of flammable liquids, greases, etc., where a blanketing effect is essential: (1) *foam,* in which the chemicals used are sodium bicarbonate, foam stabilizing agent, and aluminum sulphate; and (2) *loaded stream,* which uses an anti-freeze solution of certain alkali metal salts, expelled by pressure from cartridge or chemical reaction. For small fires in electrical equipment where the use of a non-conducting extinguishing agent is important the following types are most effective (also effective on flammable liquid fires): (1) *vaporizing liquid,* which uses carbon tetrachloride as a base and is pumped on flames; (2) *carbon dioxide,* which contains this agent in liquid form under pressure and is released as a gas; and (3) *dry chemical,* employing dry sodium bicarbonate which is expelled by a compressed inert gas.

DEWAYNE E. NOLTING,
National Fire Protection Assoc.

Firefly. See GLOW-WORM.

Fire Insurance. See INSURANCE.

Fire Island, or GREAT SOUTH BEACH, a flat sandbar, 45 m. long, off the s. shore of the middle of Long Island, separating Great South Bay from the Atlantic Ocean. The lighthouse near the w. end, lat. 40°37′57″, long. 73°13′08″, is one of the two points of the coast first sighted by incoming steamers. It has a light of the first order, 167 ft. above mean high water. Margaret Fuller Ossoli, together with her husband and child, were drowned off the shore of Fire Island in 1850.

Fireproof Building Construction refers to a building with structural members constructed of non-combustible materials of such quality and so protected that they will meet satisfactorily the test of fire. The development of building construction since 1900 has brought about a gradual increase in the number of fire-resistive buildings. The modern tendency is to design buildings in accordance with the probable severity of fire that may be anticipated by considering the character and amount of contents and the fire protection provided, just as floors and structural members are designed for the loads they are likely to carry. Building codes vary their fire-resistance requirements in accordance with occupancy classifications. (While the word 'fireproof' is still commonly used in building codes, the term 'fire-resistive' is more accurate because no material available for construction is proof against damage by fire of sufficient intensity and duration.)

The principal elements of a fire-resistive building include walls of masonry or reinforced concrete and non-combustible framing which is ordinarily of reinforced concrete or structural iron or steel protected with fire-resistive materials. Floors, roofs, and permanent partitions must also be of non-combustible materials conforming to a definite period of fire resistance. Room partitions, floor coverings, and other trim, while not necessarily of non-combustible materials, should not contribute to the spread of fire.

Floors should form barriers to the vertical spread of fire, making important the protection of vertical openings. Unprotected floor openings permit drafts which fan a fire and carry heat and smoke to upper stories, where the combustible contents on these floors may be ignited or escape of occupants cut off. To protect large floor openings, substantial fire-resistive walls or partitions are used in modern practice for enclosing stairways, elevators, and other openings such as those for large shafts for ventilation, light, or pipes.

Fire-resistive floors are generally (1) terra-cotta, brick, or concrete arches (curved or flat) of short span, *i.e.,* 4 to 6 ft. carried by steel beams (joists) spaced to suit the span of the arches, these in turn carried on main beams (girders) which rest on the walls or are bracketed to the columns; or (2) reinforced-concrete beam constructions of long span (15 to 25 ft.), extending from column to column without intermediate beams, usually carried by steel beams running directly between adjacent columns. The types of floor employed have been numerous, especially since the rise of the reinforced-concrete design. The accompanying drawings show representative types. It is worth noting that tile and brick have been used in reinforced floor constructions, by placing steel mesh

Fireproof Construction

or other metal either on the lower face or in the vertical joints, to take the tensile stresses arising in beam action.

Preventing the spread of fire horizontally is important in buildings of large area housing large amounts of combustibles or containing hazardous processes. Such floor areas are divided into smaller areas with fire walls or fire partitions and placing fire doors at openings between these areas. In this way a fire may easily be confined to a single area or section of one floor. In fire-resistive buildings which are in close proximity to other buildings and are, therefore, subject to exposure fires, window and other exterior openings should be protected by wired glass in metal sash, fire shutters, or by other means.

The cast-iron columns or steel beams or columns of a building require to be protected from the heat of fire and the effect of water streams when heated, as heat makes the metal weak and plastic sufficiently to cause collapse in a fire, if the protection were omitted; while sudden chilling by water is apt to shatter the heated parts. The floor arches or slabs must therefore be so formed as to surround the supporting beams and cover all metal with at least 2 to 4 in. of insulating cover. The illustrations show how this is accomplished in different forms of floor. Some types employ separate suitably shaped blocks of terra-cotta to encase the exposed lower flanges of the beams. The structural columns, beams, girders and trusses require to be encased in concrete, tile, gypsum, or other suitable protection to insulate them from excessive heat.

It is still customary to employ wood for the interior trim of fireproof buildings. The best practice, however, favors the use of metal frames, doors, sash, and trim, so that the building itself may be completely incombustible. In tall buildings (skyscrapers) it is most important to carry fire-resistive construction into every detail, as the major part of such a building is elevated above the range of effective fire-department work from the outside. On account of the difficulty of forming sheet-metal into trim, however, it has come into use slowly, and recourse has often been had to 'fireproofed' wood, *i.e.*, wood rendered non-flammable and slow-burning (fire retardant) by impregnation with suitable chemicals (see FIREPROOFING).

Fig. 1.—*Brick Arch Floor Construction.*
(From Carnegie Handbook.)

Semi-Fire-Resistive Construction.—Complete fire-resistive building construction is sufficiently more expensive than wood or part wood construction to prohibit its use in some instances and in other instances such severe requirements are not essential to reasonable safety against destruction by fire. Semi-fire-resistive construction provides for less severe requirements for buildings of limited size in which the combustible contents are a lesser fire hazard. Lighter structural members and protective coatings which will resist fire for shorter periods are employed. Virtually the same kinds of non-combustible materials are used in both types. Decision as to whether any given building should be of the fully fire-resistive type or semi-fire-resistive type depends on the intended occupancy or use, area and height, amount and kind of private fire extinguishing facilities, and location of the building.

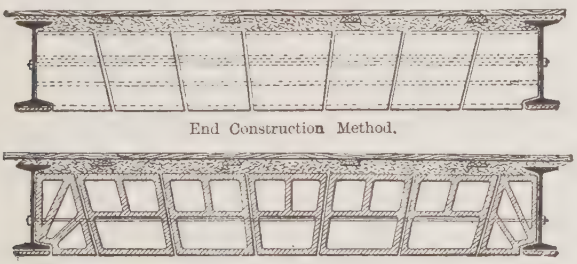


Fig. 2.—*Two Forms of Hollow-Tile Floor.*
(From Carnegie Handbook.)

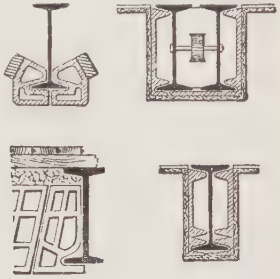


Fig. 3.—*Some Types of Beam and Girder Protection.*
(From Carnegie Handbook.)

Slow-Burning or Mill Construction.—Wooden framing is made much more fire-retardant if the timber is so arranged as to give least surface for the fire to feed on. To this end, the material must be massed in large sections, *i.e.*, in heavy columns, large-size beams, and therefore also long-span thick flooring. In New England this principle has been fully developed, constituting the well-known 'mill construction.' With floor spans of 8 to 10 ft. between beams, requiring for factory loadings very thick flooring, and columns spaced 15 to 20 ft. apart, this construction is very different from close-joisted timber framing, and by having less surface and greater thicknesses, both the surface of attack and the loss of strength by a given depth of penetration of fire are greatly reduced. In this construction the connection of beams with columns is usually by means of cast-iron bracket caps. The walls are of brick. Interior fire-walls, automatic sprinklers, fire alarms, fire doors, and shutters are usually provided in mill-construction buildings to give maximum safety.

Until well after 1900 practically all of the finest industrial buildings were of mill construction. By 1935 mill construction had been largely supplanted by fire-resistive construction because the relative cost of timber gradually increased and there became little to choose between the two types of construction so far as cost was concerned. Consequently fire-resistive buildings since about 1925 have been commonly erected.

DEWAYNE E. NOLTING.

Fireproofing of wood and fabrics involves process to reduce combustibility by the use of chemicals. Such processes are of value in reducing the susceptibility to ignition and rate of burning of light combustible materials, but no chemical fireproofing treatment can make combustible materials the equivalent of non-combustible materials. Most chemicals used are more or less soluble in water and leach out after continued exposure to the elements. No practicable treatment has yet been developed which is permanently effective for exposed wood such as shingle roofs. Treatments should not reduce the strength or promote deterioration of materials treated. The cost of treatment should be moderate if it is to be practicable; if too expensive it may be preferable to use a non-combustible material.

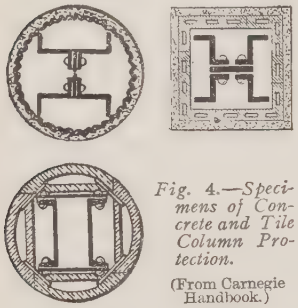


Fig. 4.—Specimens of Concrete and Tile Column Protection.

(From Carnegie Handbook.)

Fireproofed Wood.—(1) The natural combustibility of wood can be decreased by treatment with fire-retardant chemicals. In a common method the wood is sealed within a cylinder and by the use of pressure the treating solution is forced into the wood. Thorough impregnation makes wood sufficiently fire-resistive that it will not of itself support combustion, but it can be destroyed by continuous exposure to intense heat. The fire-retarding effect obtained by impregnation depends upon (a) the kind of chemical used, (b) the quantity of chemical injected, and (c) the depth of impregnation.

The Forest Products Laboratory of the U. S. Forest Service has investigated the fire-retarding properties of a large number of chemicals and published the results in *Proceedings* (1930–35) of the American Wood Preservers' Assoc. Some of the more effective chemicals in stopping both flame and glow are diammonium phosphate, monoammonium phosphate, monomagnesium phosphate, and phosphoric acid. Wood treated with fire-retardant chemicals has been used mainly for interior finish, floors, and partitions in fire-resistive buildings under requirements of various municipal building codes.

(2) Certain coating materials also provide some protection against ignition of wood and spread of flame. The customary finishing materials for wood such as stains, oil paints, varnishes, shellac and lacquers are of no particular value in protecting wood against fire and they may even increase the combustibility. The most effective fire-retardant coatings are themselves non-flammable and form a protective film over the wood that persists even at high temperatures or emits non-combustible gases that dilute the flammable gases from the wood, or both. Their principal value is in reducing the number and spread of fires originating from small sources, but are not so suitable for protection against high temperatures for a long time as are impregnation treatments. Fire-retardant coatings are of two classes: (a) special oil paints for exterior use, and (b) cold water paints mostly for interior use. In general, cold water paints, including sodium silicate, whitewash, and some proprietary products, are the most effective in retarding or checking combustion.

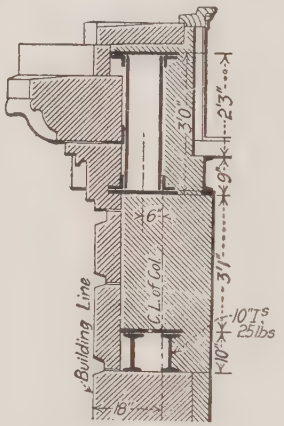


Fig. 5.—Part of Front Wall of a 24-story Office Building, showing how the Steel Girders are encased in the Masonry.

(From 'Engineering News.')

Fireproofed Fabrics.—Treating fabrics is similar to that of wood, but is simpler because there is comparatively little difficulty in securing complete penetration of the fireproofing chemical throughout the fabric. Theatre scenery and decorations in places of public assembly are generally required by law to be fireproofed, but the effectiveness of the treatments used are somewhat uncertain in many instances. Fire-retardant treatments are particularly needed for awnings and tarpaulins used to cover products in transit on railroad flat cars which are subject to ignition by carelessly discarded cigarettes or locomotive sparks. Many treatments have not proven permanent after long exposure to the weather. One effective treatment combines fireproofing chemicals with waterproofing to prevent leaching out of the chemicals. A mixture of half borax and half boric acid, applied in water solution by dipping or spraying, is about the most suitable treatment for fabrics such as theatre scenery which are not exposed to the weather and where a soluble fireproofing agent may accordingly be used.

In addition to making wood and fabrics fire-retardant, the term fireproofing is sometimes applied to various methods of protecting combustible surfaces in buildings or protecting structural parts subject to injury in a fire with facings of fireproof material. Used in this connection, the term is relative. Thus, in an ordinary non-fire-resistive building a sheet-steel ceiling covering or an asbestos sheeting over a wooden partition would constitute fireproofing. When applied to fire-resistive buildings the term has a stricter meaning, and refers to protecting exposed structural members and other metal parts with coverings of concrete or other fire-retardant materials.

DeWayne E. Nolting.

Fireproof Materials are protective coverings used to insulate structural members of fire-resistive buildings against a rise in temperatures which would, by softening or expansion, seriously impair or destroy their strength and usefulness. Such materials are also used to prevent transmission of dangerous temperatures through walls and floors to other parts of buildings where additional combustibles may be ignited. They are to be distinguished from refractories, which are substances capable of resisting the high temperatures of blast-flame furnaces (fire-clay, porcelain, magnesia, etc.). Fireproof materials need be able to resist only the lower temperature and less long-continued heat of fires occurring in burning buildings. Refractories are relatively frail in many respects, but fireproof materials must possess a suitable combination of strength, toughness, wear-resistance, resistance to action of water streams when hot, etc., so as to make them serviceable for structural pur-

poses in buildings and related structures. Sometimes, they are employed only as a protecting facing for steel or iron (in rare cases also for wooden) parts, to shelter these from the direst effects of the heat of the fire.

Whether used as carrying elements or as protection, they must be completely non-combustible, be neither melted, cracked nor otherwise attacked, or materially weakened in strength at temperatures up to 1,500° F. to 1,800° F., and be sufficiently coherent and strong to resist, even when hot, the attack of a hose stream. In the case of protection materials, a low heat-conducting power is an important desideratum.

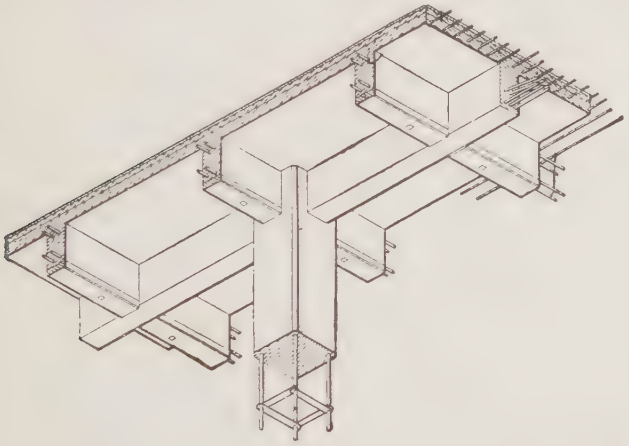


Fig. 6.—Isometric Perspective Sketch of Columns and Floor Construction in Reinforced Concrete.
(From Buel & Hill's Reinforced Concrete.)

Even the most resistive of building materials will expand under heat of sufficient intensity, and unequal expansion due to unequal heating can do serious damage. The principal work of fireproof coverings therefore is to exclude as much heat as possible and to absorb uniformly the relatively small amount of heat which enters. Steel expands eight parts in a million for each degree Fahrenheit, which means that if it is heated 1,000 degrees it can expand 9½ inches in a 100-ft. length. From this it can be seen why bare steel trusses exposed to heat from fire have been known to wreck walls although the general temperature inside the building did not become high enough to cause general ignition of combustible contents. Complete failure of steel under tension may occur as low as 1,200° F. Bare steel columns have a maximum limit of 900°–1,100° F. Building codes require that walls, beams, floors, and various other parts of buildings meet certain standards of fire resistance, measured in hours during which the member should stand up under fire of specified intensity.

(*a*) Brick and other burned-clay products—as hollow terra-cotta blocks and tile—and (*b*) concrete are the most perfect fireproof materials. Materials of both classes may be used to form either structural or protective parts. Concrete exposed to long-continued hot fire undergoes a slight surface disintegration by calcination and spalling. Cinder concrete is least affected, but is of low strength—therefore not used for structural parts, except for floor slabs and arches, where the intended loading is moderate—and is rather easily scoured by a fire stream when hot. Its thermal conductivity is very low, however, which makes it the best material for protection uses. Rich stone or gravel concrete is used where strength is needed. Reinforced concrete is equally fireproof with plain concrete; no harmful effect of the heat on the embedded steel rods has been observed—at least, whenever their original depth below the surface was an inch.

Other fireproof materials are gypsum, metal lath and plaster, and combinations of various types of materials. For details, see various sources, such as National Board of Fire Underwriters, *Recommended Building Code* (1934); Pacific Coast Building Officials Conference, *The Uniform Building Code* (1937); Building Code Committee (discontinued in 1934) of the U. S. Department of Commerce, *Recommended Minimum Requirements for Fire Resistance in Buildings*; Crosby-Fiske-Forster, *Handbook of Fire Protection* (8th ed. 1936).

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Fire Protection denotes (1) equipment and organization for fighting fires, and (2) those details of construction and equipment of any building (or of groups of buildings, communities, or even whole cities) which have the object of preventing the inception or spread of fire, or reducing the danger to life in case of fire. In the second aspect, fire protection is a specialized study, one which has the broad purpose of minimizing fire losses by prevention rather than by fire-fighting. The chief credit for developing this study practically belongs to municipal fire departments, the National Fire Protection Association, and various fire insurance interests.

The reduction in fire waste in American cities may be partially attributed to the advancement in the application of scientific fire-fighting equipment. Thus science lends its powerful aid to fire departments in the prevention and extinguishment of fires and the saving of lives through modern first-aid treatment.

The Underwriters' Laboratories, Inc., have done valuable work on explosive vapor-air and dust-air mixtures. The United States Bureau of Standards and other institutions have also studied the severity of explosions of various mixtures, and the development by manufacturers of electrical and other devices of the explosion-resisting type for use under these conditions.

Periodical dwelling inspection by local fire departments yields good results in reduced fire losses. Many cities, seeing the beneficial results accomplished in other localities, instituted periodical dwelling inspection campaigns. In addition to reducing loss of life and property, such work by firemen is building goodwill for the fire department and the city administration at no extra cost to the taxpayer.

Only since about 1930 has the training of firemen been paid the attention this important subject deserves. In 1925 there were but two schools devoted to this purpose; by 1938 there were about 500 State and regional schools in the United States and Canada. The various agencies promoting this activity have realized the need for developing uniformity of training procedures and subject matter.

The idea of mutual aid systems or coöperative fire-fighting, whereby neighboring fire departments assist each other at big fires, is favorably gaining ground. Hundreds of communities throughout the United States en-

joy this extra fire protection with little or no additional cost. Small communities that have no fire-fighting facilities of their own are awakening to the necessity of making some provision for fighting fire. Local departments are organized or contracts effected with nearby city departments to furnish this service. Contracts usually specify a certain charge, such as $50 per run, a flat rate per hour, or a certain rate per piece of apparatus.

One measure of the results of fire prevention and protection work is the continued downward trend of the national fire loss. As for arson losses, more practical laws, greater interest and efficiency of officials charged with the investigating and prosecution of arson and a wider public interest in crimes of this character have contributed to this decline.

(1) *Fire-fighting service* is a public undertaking (see FIRE DEPARTMENT), except that large industrial establishments often maintain a private fire-fighting organization, with suitable portable apparatus. The fixed equipment now installed in all factories and large stores and commercial establishments of all kinds (hose reels, standpipes, supply tanks, fire-pumps, sprinklers) belongs under the second head, prevention service. Employees are given periodical fire drill.

(2) *Preventive Fire Protection.* As regards construction, fire-resistive construction is a first desideratum; but it is not all-important—first, because the contents of a building are usually combustible in any case; second, because fire-resistive construction is too costly for universal use; third, because an excellent degree of safety can be attained even in buildings of combustible construction, as proved by the phenomenally low percentage of fire losses in the New England textile mills (largely wooden-interior buildings). However, with the modern perfection and cheapening of fire-resistive construction, it has become the first point of fire protection.

Prevention of interior fires is essentially a matter of avoiding the creation of any special hazards. This is really equivalent to a few obvious principles: segregate carefully the more dangerous inflammables (oil, explosives, etc.); keep fire or flames away from combustible materials; protect by heat insulation or metal sheathing and the like all parts where heat is localized; and enclose or otherwise protect all places where sparks or sudden heating may occur. These principles have led to the formulation of highly detailed rules on various phases of building construction and equipment—as those for the installation of electric wiring motors, and fittings, to the prohibition of the use of gasoline and other light oils except under properly regulated conditions, etc.

Prevention of fire caused by communication from the outside (exposure fires) is usually attained by requiring the walls to be of fireproof material, the roofing to be fireproof or at least semi-fireproof (no shingle roofs), and the window openings to be protected either by attaching sheet steel or tin-covered wooden shutters, or by making frames and sash of metal or metal-covered wood, with glazing of glass in which wire netting is embedded (wire glass). However, neither fire shutters nor wire-glass windows give complete protection in a long-continued exposure fire.

The most important object of fire protection, however, is the prevention of the spread of fire. When accidental fires of various kinds arise they should be confined to the immediate point of origin. In fire-resistive buildings this is attained by subdividing the interior into numerous separate compartments. Vertical separation is more important than horizontal, on account of the strong tendency of a fire in a building to spread upward very rapidly. It is essential, therefore, to avoid having openings in floors, and to enclose the stairways and elevator shafts within fireproof walls. The greater the amount of material of combustible character stored in a building, the more important is this complete separation of floors. Horizontal separation is secured by providing brick or other fire walls at suitable intervals, and guarding the doorways and other openings in these walls with self-closing fire doors. Such doors are made of metal or metal-covered wood, like fire shutters, and are hung on rollers running on a track that slopes down toward the closed position of the door. The door is held open by a rope carrying a counterweight, and in the rope is a double link held together by an easily melting solder; whenever the temperature in the room rises to about 100° above normal, the solder in the link melts, releases the counterweight, and allows the door to roll down its track and close.

The *automatic sprinkler* is a valuable device for keeping a fire from spreading, and extinguishing it. The sprinkler consists of a gridiron of water pipes under the ceiling, spaced 8 or 10 feet apart, carrying a sprinkler head every 6 to 8 feet along each pipe. The sprinkler head is a small nozzle directed upward, closed by a plug valve held down by a fusible link. When a fire occurs in the room the hot air rising to the ceiling melts some of these links, the nozzles sprinkle water down on the fire. Sprinklers are used widely in factories containing large amounts of combustibles.

Factories, stores, buildings of public assembly, and all buildings higher than five or six stories should be equipped with a water-pipe system independent of the public supply, with an elevated tank feeding it. There should be hose reels on this system at numerous points in the building. A fire alarm connected with the public alarm system is generally provided in large or isolated buildings. Automatic alarms (fire detectors) are often used; these are thermostatic devices which turn in the telegraphic alarm when the room temperature rises to a point indicating danger.

In addition to automatic sprinkler systems, there are several other types of installations for buildings and special hazard manufacturing processes which extinguish or prevent fire by excluding air from the burning surface. Such systems use foam, carbon dioxide, inert gas, steam, and carbon tetrachloride; each is effective on certain types of fires and not effective on others.

A most important phase of fire protection is the safeguarding of the occupants. This centers in providing safe exits of ample capacity, including fireproof stairways and outside fire escapes. Many fatal theatre fires have directed special attention to the danger in theatres, and the matter of passageway area and exit arrangement has received careful consideration. Similarly the elimination of combustible material in hangings and other furnishings is more important here than in other buildings.

The problem of fire protection and fire prevention (both public and private), then, resolves itself into preventing the outbreak of fire, preventing the serious spread of fire, and providing for the prompt detecting and extinguishing of fire. Proper building construction and fire protection equipment is not the whole solution because most fires are man-made and to prevent them requires an extensive program of public education in good housekeeping, care with matches, cigarettes, and the use of common sense with ordinary fire hazards.

The building codes and fire prevention codes of most cities are drawn in part for fire protection purposes, and in them will be found many obvious require-

ments which are not suggested in this article.

See FIRE DEPARTMENT; FIREPROOF BUILDING CONSTRUCTION. Consult Crosby-Fiske-Forster, *Handbook of Fire Protection.*

DEWAYNE E. NOLTING.

Fires, Great. See FIRE DISASTERS.

Fire Ship, a vessel filled with combustibles, sent in among a hostile squadron, and there fired, in the hope of destroying some of the ships. According to Livy, the Rhodians made use of fire ships in 190 B.C. Their method was to hang cauldrons of burning material on spars from their ships' bows, and then to ram the enemy and set him alight. In modern times fire ships were used with great effect at the siege of Antwerp in 1585; against the Spanish Armada in 1588; during all three of the great wars between England and Netherlands; and in 1809 by Lord Cochrane against the French shipping in Aix Roads. Fire ships were used on the Mississippi during the Civil War, but met with no great success. Ships with ballast and combustibles were repeatedly used by the Japanese at Port Arthur (1904) to block the channel of the harbor when the ships were exploded.

Fire Sprinklers. See FIRE PROTECTION.

Firestone, HARVEY SAMUEL (1868–1938), American manufacturer and industrialist, was born in Columbiana county, Ohio, and was educated in the local high school and business college. He early entered the rubber-manufacturing business and in 1896 became president of the Firestone Rubber Company at Chicago. At Akron O., in 1900 he organized the Firestone Tire & Rubber Company which grew from 17 employees at the beginning to 40,000 in 1935. In addition to the manufacture of rubber tires, Firestone interested himself in the manufacture of batteries, spark plugs, brake lining and several thousand mechanical rubber goods and rubber automobile parts. He was largely instrumental in the investigation of rubber growing in the Philippines and in South American countries.

Firestone strongly encouraged the investment of American capital in rubber-growing territories. In 1926 he secured a lease on 1 000,000 acres of land in Liberia, West Africa, for the development of rubber plantations. He began operations by cultivating 100,000 acres. Besides his great industrial enterprise, Firestone devoted his activities to various other interests. He was a member of the Ohio Council of National Defense during the World War, and did much to organize the rubber division of the War Industries Board; he was president of the Rubber Association of America, 1916–18, and organized it for war service. He published *Rubber, its History and Development* (1922) and *Men and Rubber,* in collaboration with Samuel Crowther (1926).

Firestone, HARVEY SAMUEL (1898–), son of the above, American manufacturer and industrialist, was born in Chicago and educated at Princeton University. He succeeded to the vast business interests created by his father and founded the Firestone Plantations Company of Liberia, West Africa, Firestone de la Argentina, and the United States-Liberia Radio Corporation, besides also presiding over various Firestone companies.

Fire-stones are flint and iron pyrites, a fire resisting stone; a kind of sandstone such as is used in lining fire places, ovens, furnaces, etc.

Fire Walk, a ritual practised by the natives of some Polynesian islands, especially in Tahiti, as an invocation for plentiful harvests. A bare-footed procession, led by a priest, passes over a layer of stones heated by a wood fire underneath. The immunity from pain or burns has been attributed to the composition of the volcanic rock used as the stone floor, which is not a good conductor of heat. While the lower surface of the stones is very hot, the upper surface becomes merely warm. Rituals of this type were common among North American Indians and the Japanese, and have been named the 'hot dance.'

Walking over fire, actually hot coals, is also practised by certain kinds of fakirs in India, who by mental training have made themselves practically insensible to pain. In some religious ceremonies, Egyptian Mohammedan dervishes lick red-hot irons and rub them over their bare arms without showing any discomfort.

Fireweed. See EPILOBIUM.

Fireworks are products of the art of pyrotechny—the making of scenic effects by fire and chemical compounds. This art is of very ancient origin, fireworks of a kind having been known in China for many ages, while displays were given in Roman circuses from an early date. The invention of gunpowder, however, practically revolutionized the art, and researches of chemists and scientists have rendered the making of modern fireworks a fine art. The burning of certain minerals, mixed in definite proportions, gives different colored effects, and upon this fact the variations in fireworks may be said to lie.

The minerals generally used, and the color effects they produce, are as follows: barium—green; calcium—red; copper—green or blue; lithium carbonate—purple-red; salts of strontium—crimson; sodium—yellow; sulphide of antimony—white; sulphide of arsenic—white.

Charcoal and sulphur are greatly used, too, and mixed with a proportion of niter form gunpowder. After the compounds have been mixed they are packed in cylindrical cases, generally made of pasteboard; the cases are made with mathematical precision, for much depends on their size and shape.

Among simple fireworks are crackers, squibs, Roman candles, stars, sparks, maroons, Bengal lights, jack-in-the-boxes, colored fire, etc., while the more complicated are rockets, bombs, rotating or Catherine wheels, and set pieces (battles or portraits).

During the World War fireworks were used for purposes of temporary illumination and as signals. Star shells, rockets, Véry lights and other contrivances were employed on the battlefield at night. Maroons were sent up in London to signal the approach of hostile aircraft. Lieut.-Colonel F. A. Brock, R.A.F., of the famous firm of pyrotechnists of that name, devised the lights for the Dover barrage and the rockets and smoke screens used in the naval attacks on Zeebrugge and Ostend. Consult A. St. H. Brock, *Pryotechnics, The History and Art of Pyrotechny* (1922). See also PYROTECHNICS.

Fireworm, species of caterpillars that feed on foliage and leave the trees with an appearance of having been burnt.

Fire Worship was one of the most ancient forms of veneration adopted by mankind. Together with sun worship and earth and water worship this cult can be traced in various phases from antiquity to the present. The Sacred Fire played an important part in the ritual of the ancient druids and its worship is still practised among primitive races. The old American Indians, the Aztecs of ancient Mexico, the Chaldeans, Assyrians and ancient Egyptians, all had some type of fire worship in their religious rituals. Hymns are addressed to the fire god Agni in the *Rig-veda.* The cult was also adopted by the early Indo-Aryans at a later period. Consult MacCulloch, *Religion of the Ancient Celts;* Macdonell, *History of Sanskrit Literature.*

Firing. See POTTERY.

Firishtah. See FERISHTA.

Firkin, a small cask of liquids, fish, butter, etc., originally containing a quarter of a barrel. The word now denotes a wooden vessel of no fixed capacity.

Firm. See PARTNERSHIP.

Firm'ament, a word formerly used to signify the vault of heaven. The term found its way into English from the Vulgate, and was specially employed by the Hebrews to denote the hemisphere above the earth. The notions of solidity and expansion were both contained in the Hebrew conception of the firmament. The blue ethereal sky was regarded as a solid crystal sphere, to which the stars were fixed, and which was constantly revolving, carrying them with it. It was found that many of the heavenly bodies had independent motions, inconsistent with the notion of their being fixed to one sphere or firmament. Then the number of crystalline spheres was indefinitely increased, each body that was clearly independent of the rest having one assigned to it. See PTOLEMAIC SYSTEM.

Fir'man, the name given to edicts issued by an Oriental prince, especially the Sultan of Turkey or one of his ministers. It also denotes a passport or permit of residence granted to foreigners in Turkey.

Firminy, fēr-mē-nē', town, department Loire, France; 8 miles by rail southwest of St. Etienne. The coal mines nearby have been known since the thirteenth century. Steel and iron products, ribbons, hosiery, and buttons are manufactured. Pop. 20,194.

Firozabad, fē-rōz-ä-bäd', town, United Provinces, India; 20 miles east of Agra.

Firozpur, or FEROZEPORE, cantonment and capital of Firozpur district, Punjab, India; 47 miles southeast of Lahore, on the old course of the Sutlej, some 3 miles from the present river. Founded, it is said, by Firoz Shah, emperor of Delhi (1351–87), and at one time a large and important town, it had sunk into poverty and insignificance before it actually came, in 1835, into the possession of the English. Since then the place has regained much of its former consequence, and it possesses the largest arsenal in the Punjab. Pop. (1931) 54,-351.

The district has a population of about 1,098,248.

First Aid, a term applied to the more or less skilled emergency treatment of injuries before regular medical or surgical assistance can be obtained. Impressed by the amount of avoidable suffering and loss of life that occur as a result of ignorance, the members of St. John's Ambulance Association of London took steps in 1877 to disseminate a knowledge of those measures which might with safety be employed pending the arrival of professional aid. Classes were started for the instruction of the public, and the movement met with such success that its extension throughout Great Britain speedily followed. Courses in first aid were also given about this time by Esmarch (q.v.) of Kiel; St. Andrew's Association undertook similar work in Scotland; and various societies sprang up in different parts of the world with the same beneficent objects.

In the *United States* the first aid movement was inaugurated by the State Charities Aid Association of New York in 1882 by the establishment of a course of lectures. The work as originally started was rapidly outgrown, and in 1883 the Society for Instruction in First Aid to the Injured was organized with the object of disseminating information concerning the preliminary treatment and nursing of the sick and injured, and the laws of health. Over 45,000 pupils have received instruction through this association to the present time, and 68 classes, including 2,556 pupils, were conducted in 1916.

First aid instruction in the United States is also given by the National First Aid Association of America, organized in 1905; by the American National Red Cross (see RED CROSS); and by various other agencies. Instruction is generally given by means of lectures on the elementary facts of human anatomy and physiology, and on the general principles of surgery to be applied in the treatment of fractures and dislocations, or in injuries of the soft parts, supplemented by practical work. The pupils are drilled and trained to keep cool in emergency, to arrest hemorrhage, to practise artificial respiration, to carry wounded patients, to administer simple and safe remedies in cases of poisoning, and to guard the victim of accident or sudden illness from the further dangers of injudicious handling or neglect. Under competent supervision classes of both sexes are formed, and at the end of each course an examination is held, those competitors who satisfy the examiner receiving a diploma certifying to efficiency.

An abstract of the more common first-aid measures is here given, although printed information alone cannot replace the practical instruction and drill of a class.

Accidents.—As a rule, the victim of an accident should be allowed to remain where he has fallen until the nature of his injuries has been ascertained, and until mechanical or other contrivances have been applied to render removal safe. A space should be cleared around him, he should be placed in as comfortable a position as possible, and all tight clothing should be loosened. If it is essential to move the patient, he may be lifted by turning him prone upon his face, and, standing astride his body facing toward his head, raising him to his knees with the hands under the armpits, then clasping the arms around the lower chest, lifting him to his feet. He may then be supported in the erect position, or carried in the arms, across the shoulder, or on the back. If two or more bearers are available he may be conveyed on a seat made by their joined hands, or he may be carried by the extremities, or in the supine position. Litters are readily improvised, when necessary, from window shutters, boards, ladders, or doors, or from clothing, blankets, rugs, sheets, etc., tacked or folded over poles. In all serious accidents and emergencies a physician should be summoned, and until his arrival the efforts of bystanders should be directed to the diminution of danger and suffering.

Hemorrhage, or *Bleeding,* may be external or internal. External hemorrhage may result from wounds of capillaries, veins, and arteries. Capillary bleeding is manifested by a general oozing from the wounded vessels, and usually ceases spontaneously; or it may be arrested by slight pressure of the finger or of a fold of lint applied over the wound with a moderately tight bandage. Venous hemorrhage may generally be arrested (1) by removing any article of dress, as a garter, which obstructs the return of blood to the heart; (2) by elevating the limb; (3) by applying pressure on the farther side of the wound from the heart; and (4) by direct pressure over the wound by a hard, flat pad, such as a slice of cork or a small coin wrapped in lint and maintained in position by a firm bandage.

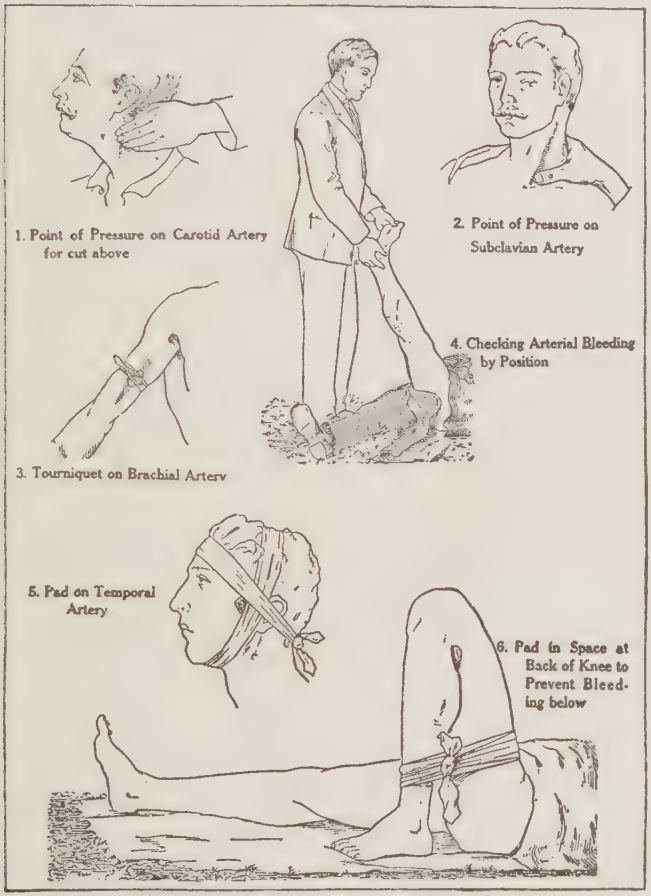
Arterial bleeding is the most serious form, as it is the most difficult to check, and its treatment demands a knowledge of the course pursued by the principal arteries. For temporary arrest digital pressure—*i.e.*, pressure with the fingers—may be applied, either directly over the bleeding point, or upon the artery nearer the heart at a point where the vessel can be compressed against a bony surface. As digital pressure cannot be maintained indefinitely on account of the pain to the patient and of the fatigue cramp of the operator's fingers, a tourniquet (q.v.) is generally employed to compress the artery. This may be improvised from a pad held in position by a bandage, which in the first place is applied rather loosely round the limb or round the head, and is

First Aid

subsequently tightened by being twisted with a stick passed beneath one fold of the bandage. A second bandage is then applied to prevent the stick from moving.

In the lower limb the femoral artery may be compressed where it crosses the brim of the pelvis, at a point midway between the iliac spine and the symphysis pubis (see PELVIS). From this point the vessel passes down the inside of the leg to become the popliteal artery at the back of the knee, and it may also be compressed against the inner aspect of the femur three inches below the pelvic brim. The popliteal artery is best controlled by placing a firm pad at the back of the knee joint, which is then bent, and the leg is bandaged firmly to the thigh in the position of extreme flexion. In hemorrhage from wounds on the sole of the foot, pressure should be made upon the posterior tibial artery where it passes over the tibia in the centre of the hollow behind the inner ankle. In the upper limb the subclavian artery may be compressed as it crosses the first rib behind the centre of the clavicle. The axillary artery may be controlled by pressure against the upper part of the humerus, high up in the armpit. The brachial artery may be compressed against the shaft of the humerus, at the inner edge of the biceps muscle, which must be pressed aside. It may also be controlled by bandaging the flexed forearm to the upper arm after placing a pad in the bend of the elbow.

For wounds of the face, pressure may be made on the temporal artery against the bony prominence in front of the upper part of the ear or on the temple. The facial artery may be compressed an inch in front of the angle of the lower jaw, while the carotid may be pressed against the cervical vertebræ by deep pressure downward and backward an inch to the side of the prominence of the windpipe.


1. Point of Pressure on Carotid Artery for cut above
2. Point of Pressure on Subclavian Artery
3. Tourniquet on Brachial Artery
4. Checking Arterial Bleeding by Position
5. Pad on Temporal Artery
6. Pad in Space at Back of Knee to Prevent Bleeding below

From the American Red Cross Abridged Text Book on First Aid.

Simple Methods to Arrest Hemorrhage.

In all cases the pressure applied should be the minimum necessary to arrest the hemorrhage, and it should be maintained only so long as bleeding threatens. The sooner a surgeon can be got to secure the cut artery by ligature, should that operation be required, the less damage will the tissues suffer from the arrest of their blood supply.

Bleeding from the nose is controlled by a number of special measures, for which see NOSE.

In internal bleeding — *e.g.*, from the lungs or stomach — the patient should be placed recumbent, the clothes should be loosened, especially at the neck, small quantities of ice or of iced water should be given, and ice bags should be used externally. When cerebral hemorrhage is diagnosed, the patient should have the head slightly raised, and ice and cold water may be applied to the forehead and scalp. (See HEMORRHAGE.)

Wounds. — The chief indications in wounds are to control hemorrhage, treat shock, and prevent infection by mild antiseptic washes and dressings.

Practically all wounds of any severity, as well as other injuries, are accompanied by a certain degree of *shock*, or depression of the bodily functions, which is to be treated by stimulating those functions in every way. The patient should be placed flat on his back, and covered warmly, and hot bottles or bricks should be placed around the body. The arms and legs should be rubbed, and half a teaspoonful of aromatic spirits of ammonia in half a glass of water should be administered as soon as swallowing becomes possible. (See SHOCK.)

In extensive *contused and lacerated injuries*, as those caused by machinery and railroad accidents, the torn parts should be covered with bandages, replaced as far as possible in the normal position, and held in position by a splint. In *punctured wounds of the chest*, a thick pad of gauze should be applied and the chest strapped, unless the heart has been pierced, in which case there is little to be done except to make the patient as comfortable as possible, and await professional aid. In *abdominal wounds* in which the intestine or stomach is extruded, this should be washed with sterile warm water or salt solution and kept covered with sterile cloths wet with the same. The patient should not be allowed to take anything by mouth. *Gunshot wounds* should be disturbed as little as possible, and no effort should be made to probe for the bullet.

Poisoned wounds include the stings and bites of insects, snake

First Aid

bites, dog bites, and human bites. Bites of the commoner insects, as flies, bed bugs, fleas, wasps, bees, etc., are simple and demand little treatment, though cold applications may be helpful when much swelling is present. Bites from large spiders, centipedes, tarantulas, and scorpions are more serious, and should be treated in much the same manner as snake bite (q.v.).

Dog bites are dangerous chiefly because of the possible development of hydrophobia. The usual measures are constriction above the wound with a tourniquet, washing and sucking the wound, and the application of tincture of iodine or a bichloride of mercury (1–1,000) wash. The Pasteur treatment should be given in all suspicious cases. (See HYDROPHOBIA.)

Human bites may result in serious infection, and should accordingly be thoroughly cleansed with antiseptics. Wet dressings of soda bicarbonate solution may also be used.

All wounds contaminated in any way by the soil, and all gunshot wounds, are potential sources of lockjaw and infection from gas-forming germs, and should be treated and dressed with peroxide or potassium permanganate solution (1–1,000). Anti-tetanic serum should be administered by a physician. (See TETANUS.)

Fractures may generally be diagnosed by the severity of the pain, the powerlessness and distortion of the limb or other part of the body, and by the preternatural mobility in abnormal directions. Crepitus may also be produced by the splintered ends of the bone, but the first-aid operator should not try to elicit either crepitus or preternatural mobility for fear of converting a simple into a compound fracture.

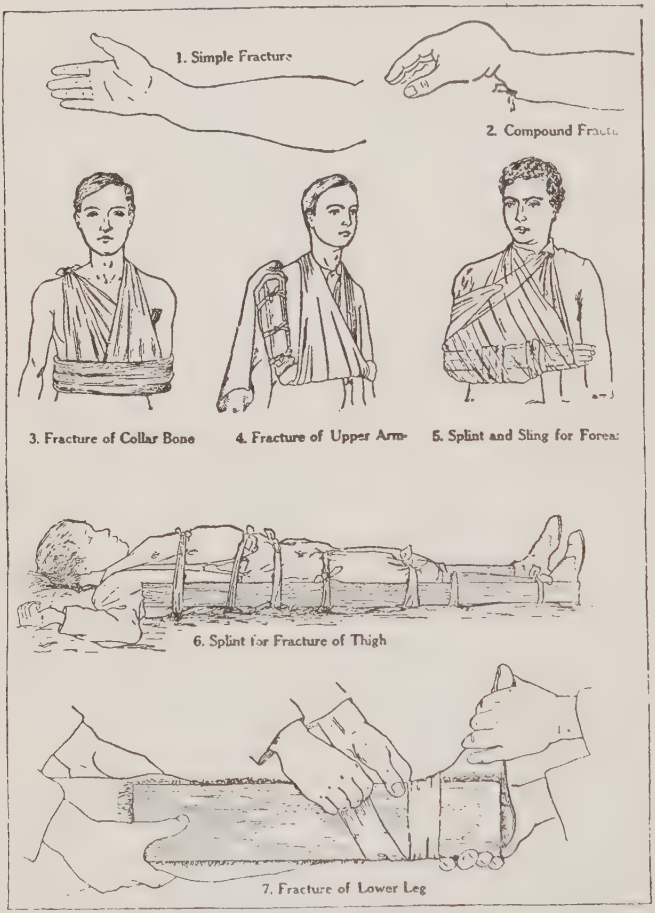
In *fractures of the limbs* the broken ends of the bone should be brought into line by extension of the limb, and should be rendered immovable by means of splints placed parallel to the broken bone and of sufficient length to command the joint above and the joint below the fracture. Splints may be improvised from walking sticks, umbrellas, rolls of paper or cloth, fire irons, or bundles of twigs or straw, and convenient triangular bandages may be made by cutting a square yard of calico or similar material diagonally across. In the first aid of simple fractures the splints should generally be applied outside the clothes, but in compound fractures hemorrhage or the nature of the wound may demand the removal of clothes. In such a case the sound limb should be unclad first, or a seam may be cut open near the wound. Hemorrhage must be arrested, and a simple dressing of lint and cold water or a mild antiseptic should be placed over the wound before the splints are applied.

In fractures of the leg bones the legs should be tied together by handkerchiefs or cords, as by this means the sound limb is made to act as an additional splint. In fractures of the kneecap the splint should extend from the heel to the buttock, the limb should be elevated, and ice bags or other cold applications and bandaging should be employed to decrease the swelling. When the arm bones are broken the injured limb must be supported by a sling round the neck, after the splints are fixed. If the bones of the hands or fingers are fractured, they should be bound on a flat padded splint, extending well above the wrist or around a cylindrical object as a piece of a broom handle or a roll of cloth.

Should the applier of first aid be in doubt as to whether or not a fracture is present, he ought to treat the case as a fracture and put on splints. Only after the fixation of an injured limb should the patient be borne to a place of shelter. If available, a stretcher should be used; but the patient may be carried on rugs or on the clasped hands of bearers, who must be careful that no pressure is made upon the damaged limb.

Fractures of the collar bone, or clavicle, are extremeiy common. In these cases a thick pad of cotton should be inserted in the armpit, extending well under the arm, which should be put in a sling and bound to the body with a suitable bandage. *Fractures of the ribs* are also of frequent occurrence, the chief indication for first aid treatment being the restriction of the chest movements by bandaging or strapping with adhesive plaster. A *broken jaw* should be bound in position by a Barton or tailed bandage.

In fractures of the skull and spine there is little that can be


1. Simple Fracture
2. Compound Fractu
3. Fracture of Collar Bone
4. Fracture of Upper Arm
5. Splint and Sling for Forea
6. Splint for Fracture of Thigh
7. Fracture of Lower Leg

From the American Red Cross Abridged Text Book on First Aid.
Fractures and Their Care.

First Aid

done before the arrival of a surgeon. In *fractures of the skull* measures may be taken to arrest cerebral hemorrhage, and sterile dressings may be applied to the external wounds, but no effort should be made to check bleeding from the nose and ear. In *fractures of the spine* the treatment should be directed to relieve shock. The patient should not be moved except in case of extreme necessity, when he may be slid onto a rigid stretcher and from that onto a firm bed.

Dislocations demand little first aid treatment beyond the prevention of movement at the affected joint until surgical assistance is procured. Unskilled efforts to reduce the dislocation may do irreparable mischief. Should the arm be the seat of injury, the limb should be supported in a sling. If the hip or knee is dislocated, rest should be secured by placing the patient on a stretcher; but if the ankle is the injured joint, the patient may be carried on a three or four handed seat. (See DISLOCATION.)

Sprains may be treated by elevating the injured part to relieve pain and limit swellings, by the application of cold water, by swathing the joint in cotton over which a fairly tight bandage is applied, and by strapping with adhesive plaster. The patient must be prohibited from using the limb. (See SPRAIN.)

Fits with loss of consciousness are due to various causes, which must be distinguished from one another in order to give appropriate first aid. A *fainting fit*, or syncope, is frequently caused by loss of blood, by shock, fright, or other excitement, and by overcrowded and overheated rooms. The patient sinks down insensible, with blanched lips and face, feeble pulse, cold extremities, and often in a cold sweat, but without bodily contortions. Such a patient should be laid on his back, and as much air as possible should be admitted to him. The clothes should be loosened, and the legs and arms may be raised. The respiration should be stimulated by sprinkling cold water on the face and neck, and by placing ammonia and water on a handkerchief before the patient's nostrils. In a crowded hall or church there is often difficulty in clearing a space in order to lay a patient down, and it is sometimes better to push his head down between his knees while he is in a sitting posture. This procedure speedily overcomes the cerebral anæmia from which the patient suffers. (See FAINTING.)

In *epileptic fits* there is a sudden fall, sometimes preceded by a cry or shriek, and followed by convulsions, which are often violent. The head and features are frequently twisted to one side, and the patient generally froths at the mouth and may bite his tongue. All tight clothing should be loosened, and the patient should be laid on his back upon cushions or rugs if possible, and restrained sufficiently to prevent him injuring himself during the convulsions. If possible, a cork or a corner of a folded towel or of something similar should be placed between the teeth in order to save the tongue from being bitten. (See EPILEPSY.)

In apoplectic fits the patient falls suddenly, is unconscious, and is usually red in the face, while his breathing is often loud and stertorous. All tight clothing should be loosened, the head slightly raised, air admitted freely, and ice or cold water may be applied to the head. No stimulants should be given. (See APOPLEXY.)

Convulsions in children are usually due to digestive disturbances. Emergency measures include a hot mustard bath (1 tablespoon of mustard in 4 or 5 gallons of water), after which the patient should be rubbed well and wrapped in warm blankets; the promotion of vomiting by mechanical irritation or by ipecac; and a warm soapsuds enema. (See CONVULSIONS, INFANTILE.)

Sunstroke frequently produces symptoms similar to those of apoplexy, but convulsions may be present. The patient should be carried at once into the shade, clothing should be loosened, and a plentiful supply of cold water should be dashed over the head, neck, and chest, or poured from a height upon the head. Ice is also good when it can be procured, and the patient should be vigorously fanned. A second form of heat exhaustion is characterized by subnormal temperature, syncope, and failure of the heart action. Treatment consists in removing the patient to cool air and administering stimulants, as aromatic spirits of ammonia or well-diluted whiskey or brandy. Hot baths are sometimes helpful. (See SUNSTROKE.)

Asphyxia (q.v.), or suffocation, may be due to drowning, choking, strangulation, or the inhalation of gases, as coal or illuminating gas. The first indication, in all cases, is to remove the cause and re-establish breathing by artificial respiration. In *drowning* all tight clothing should be ripped off, and the patient should be placed so as to allow the water to run out of the air passages and stomach. The mouth and nostrils should be wiped out, and the tongue drawn forward and held there. Artificial respiration, as described in the article on DROWNING, should be instituted at once, and continued until the patient resumes natural breathing, or until death is established beyond a doubt. At the same time the body should be kept warm with hot water bottles or similar appliances. Hot coffee or hot salt solution may be administered per rectum.

In suffocation due to the *inhalation of gases* the patient should be removed to the air, his clothing should be loosened, and artificial respiration should be employed, followed by the administration of stimulants. Persons overcome by illuminating gas require special treatment because of the poisonous effects of carbon monoxide. Those but slightly affected should be taken into the fresh air at once, and walked around with proper support on both sides. A dose of effervescing phosphate of soda in a glass of water, plain soda water, or Weiss beer should be administered, followed in five minutes by half a teaspoonful of aromatic spirits of ammonia in a glass of water. The latter dose may be repeated at intervals of fifteen minutes, but not more than four doses should be given. The patient should be kept walking until fully revived.

Patients more seriously affected, but still breathing, should be placed in a recumbent position with a support under the neck and shoulders, allowing the head to fall back. The clothes should be opened, and the skin of the arms and legs rubbed vigorously toward the body. If consciousness is restored speedily, half a teaspoonful of aromatic spirits of ammonia in a third of a glass of water may be given, and repeated twice or three times at fifteen minute intervals. If the patient does not respond to the rubbing, the mouth should be opened and cleared of froth, and the tongue pulled forward; an ammonia sponge passed under the nose as the patient inhales, and respiration aided by pressing the base of the ribs together as he exhales. When consciousness returns he should be warmly covered and surrounded with hot water bottles. In patients apparently dead artificial respiration must be resorted to. The pulmotor, an apparatus with an oxygen tank and an automatic pump, is frequently used in these cases.

Electric shock may be due to lightning or to contact with a live wire, and may cause simple unconsciousness, suspended animation, or immediate death. The first indication is to break the contact of the patient with the current, if this has not already been done. If possible, the current should be cut off at once. Otherwise, the body may be pushed away from the conductor, or the conductor may be pulled aside by any dry non-conductor, as a dry piece of wood or a tool having a dry wooden handle, the

rescuer standing on a dry wood or concrete floor; or the rescuer may grasp the victim's clothing; or, if his hands are protected by several thicknesses of dry cloth, he may even seize the body with safety. Short circuiting may be resorted to, if other methods are out of the question, but this is always dangerous.

Artificial respiration should be begun immediately, preferably by the prone pressure or Schaefer method. With the patient lying on his stomach, the face turned so that the mouth and nose are off the ground, the operator kneels astride or on either side of the patient's hips, facing the head, and with his spread hands on the patient's lower ribs throws his own body and shoulders forward so as to bring his weight to bear upon the lower ribs; the hands are then released, and the operation is repeated at the rate of about twelve times a minute for half an hour or longer. A cloth wet with aromatic spirits of ammonia may be held near the patient's nose to supplement the efforts being made by artificial respiration. When natural breathing is established aromatic spirits of ammonia may be administered. The patient should by no means be allowed to sit up until fully out of the shock.

Burns and scalds should be treated so as to be kept as clean as possible. In severe burns requiring medical attention, nothing should be applied to the raw surfaces and the patient should be hospitalized as soon as possible. The application of greasy substances introduces infection and interferes with the complete debridement and cleansing of the wounds, which must be performed to avoid widespread infection. For minor burns, soothing ointments may be applied but here also the wound must be kept as clean as possible with a sterile dressing. Tetanus antitoxin should be administered as soon as possible in all cases of severe burns. If the patient is seen while the clothes are actually on fire, he should be laid flat on the ground and wrapped in coats, rugs, blankets, or similar materials until the flames are extinguished. His injuries are likely to be much less extensive if he is kept in the horizontal position.

Poisons are divided into those which are irritant and those which are narcotic or stupefying. *Irritants* corrode or burn the tissues with which they come in contact. Traces of their action are therefore seen on the lips, tongue, and throat. The most common irritants are hydrochloric acid, oil of vitriol or sulphuric acid, nitric acid, carbolic acid, strong alkalies, ammonia, caustic potash and soda, oxalic acid, and phosphorus. They all produce intense pain in the chest and stomach, and after them the administration of emetics is dangerous, as the strain of vomiting would be apt to increase the damage done to the tissues. Oil, chalk and water, magnesia and water, soapsuds, milk, raw eggs, and flour and water are the safest things to administer in ordinary irritant poisoning; but should phosphorus have been swallowed, two teaspoonfuls of mustard in large quantities of hot water may be given.

POISON.	EMETIC OR NO EMETIC.	FIRST-AID ANTIDOTES.
Hydrochloric, sulphuric, nitric, and oxalic acids.	Give *no* emetic.	Magnesia, four ounces to one pint of water; or soap and water; or chalk or whiting and water to drink. Whitewash, scraped from wall or fence, mixed with water.
Ammonia, potash, and soda.	Give *no* emetic.	Lemon juice or weak vinegar to drink.
Corrosive sublimate.	Give *no* emetic.	Raw eggs beaten up, flour and water, and milk.
Phosphorus.	Give emetic.	Magnesia or chalk in milk or gruel.
Irritant gases.	Give *no* emetic.	Fresh air; water dashed on head and chest; artificial respiration.
Opium, laudanum, morphine, and chloral.	Give emetic.	Give hot coffee by mouth or rectum; keep patient awake.
Belladonna and henbane.	Give emetic.	Give hot coffee and charcoal powder and water.
Strychnine.	Give emetic.	Give 20 grains of tannin in water; use artificial respiration.
Prussic acid and cyanide of potash.	If possible give emetic.	Stimulate with ammonia and brandy; dash cold water on head and chest; employ artificial respiration.
Carbolic acid.	Give emetic.	Give magnesia mixed with olive oil; give raw eggs and milk.
Aconite.	Give emetic.	Stimulate with brandy and water; apply warmth to extremities, and employ artificial respiration.
Lunar caustic (nitrate of silver).	No emetic necessary.	Give copious draughts of diluted vinegar or lemon juice in water, followed by milk and olive oil.
Alcohol.	Give emetic.	Rouse the patient; give hot coffee, ammonium carbonate, and apply warmth to the extremities; employ artificial respiration if necessary.

In *narcotic poisoning* the nervous system is chiefly affected, and the drugs in most common use are opium, morphia, laudanum, belladonna, chloral, henbane, prussic acid, cyanide of potassium, and strychnine. In cases of poisoning by most of these drugs two indications should be followed without delay —(1) the stomach should be emptied by an emetic; (2) means should be taken to keep the patient awake. Warm mustard and water or a tablespoonful of common salt in a tumblerful of hot water may be given, or the fauces and back of the tongue may be tickled with a feather or with the finger. After the patient has vomited, strong coffee should be administered in copious draughts. Should drowsiness be present, the patient must be stimulated by being led about by two men, who may have to shake him and shout at him in order to prevent sleep that might be fatal. Strong smelling salts are useful, and artificial respiration may be necessary.

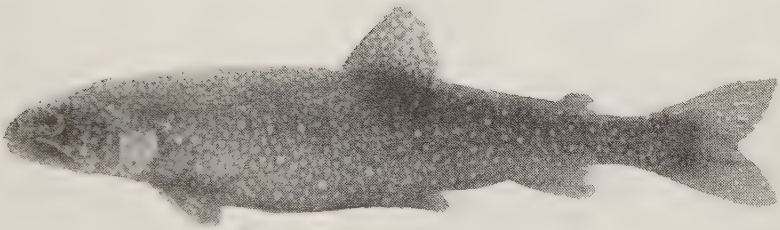
The accompanying table gives a more detailed statement of the appropriate measures for special poisons. See also the article on POISONS.

For further information see ANTISEPTICS; BANDAGING; MEDICINE; SURGERY.

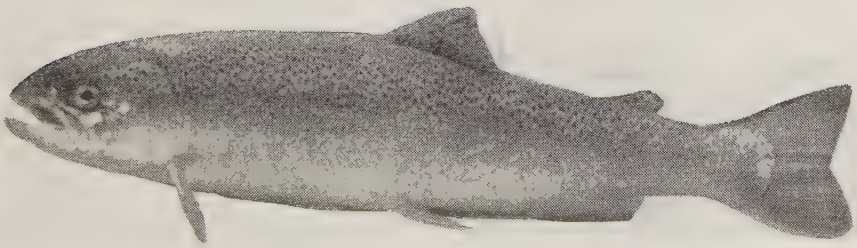
Bibliography.—Consult *Drill Regulations and Service Manual for Sanitary Troops, U. S. Army;* C. Lynch's *American Red Cross Text Book on First Aid* (1911); A. S. Morrow's *Immediate Care of the Injured* (1912); C. A. Lauffer's *Electrical Injuries* (1912); A. H. Doty's *Prompt Aid to the Injured* (6th ed., 1914); E. L. Eliason's *First Aid in Emergencies* (1915); H. R. Owen's *The Treatment of Emergencies* (1917).

Firstborn. According to ancient Hebrew usage, the firstborn male offspring, both of men and

TARPON *Tarpon atlanticus*



LAKE TROUT *Cristivomer namaycush*



Photos courtesy of the Shedd Aquarium, Chicago

SILVER SALMON *Oncorhynchus kisutch*

animals, was sacred to Jehovah, and was legally required to be offered in sacrifice. In the case of beasts (with the exception of the ass, for which a lamb was substituted), the firstborn male, if without blemish, was to be given to the priests; if blemished, it was not to be sacrificed but eaten at home (Ex. xxxiv. 19 *f.*; Num. xviii. 15 *ff.*). The Passover seems originally to have been the feast of the firstborn. According to the older custom, the firstborn male children, though claimed by Jehovah, either as a sacrifice or as prospective priests, could be redeemed with money (Ex. xxxiv. 20). A later theory makes the Levites a substitute for the firstborn males of all Israel, so that only the numerical overplus of the latter over the former require to be redeemed (Num. iii. 40 *f.*, viii. 16 *f.*). In a similar sense Israel itself was the 'firstborn' among the nations—*i.e.*, sacred to Jehovah. See also PRIMOGENITURE.

First Fruits, in Hebrew law, the earliest gathered produce of the soil, which was sacred to Jehovah or Yahweh, and offered to Him in sacrifice. Thus at the beginning of harvest a handful or sheaf of corn must be offered before the general reaping commenced; and when the grain had been safely gathered, an oblation of bread was required to be made (Lev. xxiii. 10 *ff.*). Besides national offerings, each individual brought his first fruits, grain, honey, wine, and other commodities, which were perquisites of the priest, who alone might eat them.

The primitive church defrayed its expenses by the adoption of the Jewish custom of presenting the first fruits, but this was gradually replaced by the paying of tithes. The first fruits in mediæval church history, known also as *annates*, were the first year's income of every benefice, which the Pope, and sometimes the bishop, was allowed to collect from each new incumbent. At the time of the Reformation the Papal annates were transferred to the crown, but in the reign of Queen Anne they were formed into a fund known as Queen Anne's Bounty (q.v.), used to augment the poorer livings.

The council of Constance in 1418 practically abolished the payment of annates in Germany, Belgium, France, and Spain, although some small fees, still obligatory, were often known as annates.

Firth, a Scottish name for a narrow arm of the sea, usually the outlet of a river, as the Firth of Forth. See FORTH.

Firth, MARK (1819–80), English steel manufacturer and philanthropist, son of Thomas Firth, was born in Sheffield. In 1843 he and his father established a small foundry, from which developed a great business, ultimately manufacturing nearly all the steel used for British ordnance. The firm also acquired an extensive trade in the United States. Mark Firth was a memorable benefactor to Sheffield—Firth Park (opened 1875) and Firth College (founded 1879) being among his benefactions.

Fischart, fish'ärt, JOHANN (*c.* 1545–*c.* 1590), German writer and satirist, was born in Strassburg, travelled extensively, and after his marriage (1583) became bailiff at Forbach, near Saarbrücken. His principal works are *Nacht-rab* (1570); *Flöhhatz* (1573); *Gargantua* (1575); *Das glückhaft Schiff von Zurich* (1576), one of his happiest writings; *Das podogrammisch Trostbüchlein* (1577); *Philosophich Ehzuchtbüchlein* (1578); *Der Bienenkorb* (1579), directed against the Jesuits; *Der Feldbau* (1579); *Das Jesuiterhutlein* (1580).

Fischart not only ranks as the foremost German humorist, but as a moral teacher he is worthy of place by the side of Luther and the humanists. He was a staunch upholder of Lutheran principles, and attacked the Jesuits (he calls them 'Jesuwider') with violent and often coarse satire. He had enlightened views on education, demanding that it should be national, and insisting above all on German, not Latin, as the language of instruction. His erudition was vast and he had an unequalled mastery of the German language. A. Hauffen's edition of some of Fischart's works was completed in 1895 (*Kürschners Deutsche National-Literatur*, No. 18). Selections have been edited by L. Voigt and by L. Pariser. The *Gargantua* was edited by A. Alsleben in 1891. Consult Besson's *Etude sur Jean Fischart*.

Fischer, fish'er, EMIL (1852–1919), German scientist, was born in Euskirchen, Prussia. He was educated at Strassburg and devoted himself to the study of organic chemistry. In 1878 he became professor extraordinary at the University of Munich, in 1881 was professor of chemistry at Erlangen, and in 1885 went to Würzburg. He was called to the chair of organic chemistry at the University of Berlin in 1892, and in 1902 received the Nobel prize. His most important work was in connection with the synthetic production of the simple sugars, and his investigations into the constituents of coffee and tea, which opened the way to a new branch of chemistry. His published works include *Anleitung zur Darstellung organischer Präparate* (1896, Eng. trans. 1909) and *Chemical Research in its Bearing on National Welfare* (1912).

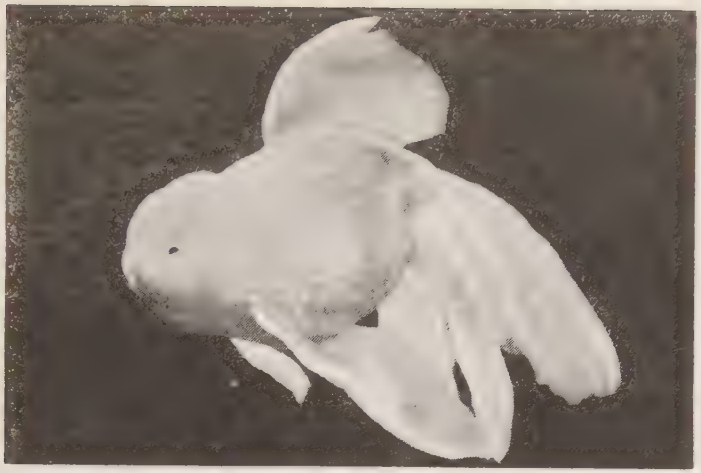
Fischer, ERNEST KUNO BERTHOLD (1824–1907), German philosophical writer, was born in Sandewalde, Silesia. He was educated at Leipzig and Halle and in 1850 became an instructor in philosophy at Heidelberg. From 1856 to 1872 he was professor at Jena, where as a clear and vigorous exponent of Hegel he acquired great influence. In 1872 he was called to the chair of philosophy at Heidelberg. His chief work is *Geschichte der neuern Philosophie* (new ed. 10 vols. 1897–1903).

Fischer, JOHANN GEORG VON (1816–97), German poet, was born in Gross-Süssen, Würtemberg. In 1860 he was appointed professor at the Stuttgart high school. His first volume of poems appeared in 1854, his last in 1896 (*Mit achtzig Jahren*). In part his lyrics recall Goethe, but they are more subdued and grave, less musical; partly he suggests the older Swabian poets, Uhland and Mörike, but much of his work is altogether personal. He spiritualizes and exalts all that he touches; he ponders the problems of life, and never becomes didactic; he observes keenly, and gladly proclaims the wonders of nature. His dramas, which are also of interest, include *Saul* (1862); *Friedrich der Zweite von Hohenstaufen* (1863); *Florian Geyer* (1860); *Kaiser Maximilian von Mexiko* (1868).

Fischeria, fish-ē'ri-*a*, a genus of tropical twining shrubs, belonging to the order Asclepiadaceæ. The best species for cultivation under glass is *F. martianus*, a Brazilian plant which grows to over twenty feet in height, and bears many-flowered umbels of white blooms in early summer.

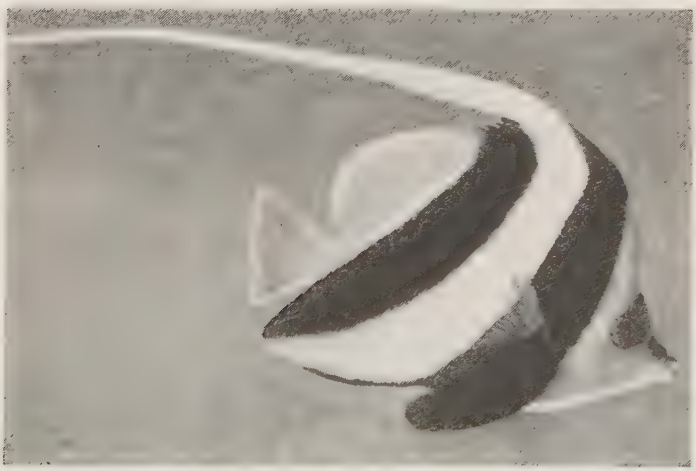
Fiscus, fis'kus, a Latin word denoting properly a wicker basket or pannier, but from the Roman custom of carrying money in such receptacles, eventually signifying a money-chest. After the establishment of the empire, it was applied to the treasury of the emperor as distinct from that of the state, which was called *ærarium* (q.v.).

Fish, cold-blooded, aquatic vertebrates in which the limbs are modified into fins, these paired fins, like the unpaired ones which are also present, being furnished with supporting fin-rays; the first pair of gill-arches is modified into jaws, and the embryo develops without any amnion or allantois. Except in Dipnoi (q.v.) respiration is effected solely by means of gills, the heart has only two chambers



ORANDA GOLD FISH. AN EXOTIC VARIETY CULTIVATED BY THE JAPANESE. IT IS A SPECIALIZED FORM OF *Carassius Auratus*

THE STRIPEY, AUSTRALIAN *Microcanthus Strigatus*, ANOTHER EXOTIC VARIETY OF FISH



THE BANNER FISH, LIVING IN SALT WATER. *Heniochus Macrolipidotus*

Photos courtesy of the Shedd Aquarium, Chicago

and contains nothing but venous blood, and the nasal sacs have no communication with the cavity of the mouth. In the majority of fish the skin bears scales which are developed from the dermis, and at each side of the body there is a 'lateral line' of sense organs. The presence of gills is sufficient to differentiate fish from aquatic mammals like whales, or from aquatic reptiles; the absence of fingers and toes and the presence of fin-rays in the unpaired fins from amphibians.

The following is an approved classification of fish:—(1) Order Elasmobranchii—skates, dog-fish, sharks; (2) order Holocephali—a few aberrant forms, such as *Chimæra;* (3) order Ganoidei—sturgeon, bony pike; (4) order Teleostei or Bony Fishes, as salmon, cod, flounder; (5) order Dipnoi—mudfish (*Ceratodus, Lepidosiren, Protopterus*). The most important of these orders is that of teleosteans, or bony fishes, which includes the majority of living fish.

For details see the articles on the various orders and on the individual varieties. See also Angling; Fisheries; Pisciculture. Consult Publications of the Bureau of Fisheries, U. S. Dept. of Commerce; H. M. Kyle, *The Biology of Fishes* (1926); L. Roule, *Fishes and Their Ways of Life* (1935).

Fish, Hamilton (1808–93), American statesman, son of Nicholas Fish (1758–1833), a Revolutionary soldier, was born in New York City. He was graduated from Columbia in 1827, was admitted to the bar in 1830, and practised in New York. In 1843–5 he was a Whig representative in Congress, in 1847 was a member of the State Senate, and in 1849–51 was governor of New York. He was a member of the U. S. Senate (1851–7), first as a Whig and then as a Republican, and vigorously opposed the Kansas-Nebraska Bill of 1854. During the Civil War he threw all his influence on the side of the national administration, and, with Bishop Ames, was appointed (January 1862) by Secretary of War Stanton a commissioner to visit the Federal prisoners in Confederate prisons, 'to relieve their necessities and provide for their comfort'; the commissioners, however, were not admitted through the Confederate lines. After the war Fish was Secretary of State in the cabinet of President Grant (1869–77), and was one of the Joint High Commission by which the important Treaty of Washington was negotiated (1871), creating a basis for the arbitration of the *Alabama* claims, and providing for the settlement of the long-standing dispute with Great Britain concerning the northwestern boundary of the United States. He was president-general of the Society of the Cincinnati after 1854.

Fish, Nicholas (1846–1902), American diplomat, son of Hamilton Fish (q. v.), was born in New York City. He was graduated from Columbia in 1867 and from the Harvard Law School in 1896, was admitted to the bar and practised law in New York City. Subsequently he was secretary of the United States legation at Berlin, United States *chargé d'affaires* at Berne, Switzerland (1877–81), and minister resident at Brussels (1882–6), later becoming a banker in New York. He was fatally injured in a personal altercation in New York City, September 16, 1902.

Fishberry. See Cocculus.

Fish Crow. See Crow.

Fisher. See Marten; Pekan.

Fisher, Dorothea Canfield (1879–), American author, was born in Lawrence, Kan. She was educated at Ohio State University and at Columbia University, and was secretary of the Horace Mann School (1902–05). She did war work in France for three years and was interested in educational questions and reforms, having served on the Vermont State Board of Education (1921–3). Her published works, which include several novels of high rank, are *Corneille and Racine in England* (1904); *English Rhetoric and Composition* (with G. R. Carpenter, 1906); *What Shall We Do Now?* (1906); *Gunhild* (1907); *The Squirrel Cage* (1912); *The Montessori Mother* (1913); *Mothers and Children* (1914); *Hillsboro People* (1915); *The Bent Twig* (1915); *The Real Motive* (1916); *Fellow Captains* (1916); *Understood Betsy* (1917); *Home-Fires in France* (1918); *The Day of Glory* (1919); *The Brimming Cup* (1921); *Rough Hewn* (1922); *Raw Material* (1923); *The Home-Maker* (1924); *Made-to-Order Stories* (1925); *Her Son's Wife* (1926); *Why Stop Learning?* (1927); *The Deepening Stream* (1930); *Basque People* (1931); *Bonfire* (1933). She translated Papini's *Christ* from Italian (1921) and Tilgher's *Work* (1930).

Fisher, George Jackson (1825–93), American physician, was born in North Castle, N. Y., and was graduated (1849) in medicine from New York University. He was in charge of the surgical department of the State prison at Sing Sing, in 1853–4, served as a volunteer surgeon for the Sanitary Commission in the Civil War, and from 1853 to 1873 was U. S. examining surgeon of a brigade of the New York national guard. Dr. Fisher was elected president of the New York State Medical Society in 1874. He collected a notable surgical library and museum, and published, among other books, *A Brief History of the Circulation of the Blood* (1877), and *Sketches of Some of the Old Masters of Anatomy, Surgery, and Medicine* (1880–3).

Fisher, John (1459–1535), English churchman, was born in Beverley, Yorkshire. He was appointed confessor to Henry VII's mother, Countess of Richmond, who was the founder of the Lady Margaret chair of divinity, and of St. John's and Christ's Colleges, the building of which Fisher superintended for her. Becoming chancellor of Cambridge University (1504), and the same year bishop of Rochester, he greatly encouraged the New Learning, beginning the study of Greek himself when about forty-five, and Hebrew three years later. For his opposition to the royal supremacy and in the matter of Henry VIII's divorce, he was sent with More to the Tower. The Pope, ignorant of his break with the king, sent him a cardinal's hat, and Henry VIII, infuriated, had him beheaded at Tyburn.

Fisher of Kilverstone, first baron (1841–1920), British admiral. John Arbuthnot Fisher was born in Ceylon. He entered the Navy at the age of 13; served in the Baltic during the Crimean War; in the Chinese War (1859); was made lieutenant in 1860, commander in 1869, and captain in 1874. He commanded H.M.S. *Inflexible* at the bombardment of the forts at Alexandria, Egypt, in 1882. Early in his career Fisher adopted gunnery and battleship construction as special studies. In 1886 he became director of naval ordnance and torpedoes; admiral superintendent of Portsmouth dockyard (1891), and later controller of the Navy. He was commander-in-chief of the North American and West Indies station (1899), and of the Mediterranean fleet (1899–1902), becoming first sea lord of the Admiralty in 1904.

In this important post Fisher displayed such tremendous energy as literally frightened the Government, naval authorities and the British public. He ruthlessly scrapped many comparatively new warships and introduced the first *dreadnought*, the 'all big-gun' battleship (launched

1906). This innovation at once superseded all capital ships of other navies. They too, now, were obliged to build *dreadnoughts;* to Germany it meant, also, that the Kiel Canal would have to be widened.

Fisher retired in 1910, but was recalled to the Admiralty in 1914, during the early stage of the World War, and resigned in 1915 over difference of opinion on the ill-fated Dardanelles Expedition. He received his peerage in 1909.

Fisher, SYDNEY ARTHUR (1850–1921), Canadian official, was born in Montreal, and educated at McGill University and Trinity College, Cambridge. He was elected to the House of Commons in 1882, 1887, and 1896, when he became Minister of Agriculture, a position which he held until 1911. He was for a time acting Minister of Public Works. He was active in the advancement of agricultural interests in Canada and promoted important legislation to that end. He published *Some Economic Aspects of Agriculture in Canada, Conservation of Our Natural Resources,* and *Canada and Its Position in the British Empire.*

Fisher, SYDNEY GEORGE (1856–1927), American writer, was born in Philadelphia, Pa. He was graduated from Trinity College, Hartford, Conn., in 1879, studied at Harvard Law School, and was admitted to the bar in 1883. He is best known as a writer on American history, his works including *The Making of Pennsylvania* (1896); *Pennsylvania: Colony and Commonwealth* (1897); *The Evolution of the Constitution* (1897); *Men, Women, and Manners in Colonial Times* (1898); *The True Benjamin Franklin* (1899); *The True William Penn* (1900); *The True History of the Revolution* (1902); *The Struggle for American Independence* (1908); *The True Daniel Webster* (1911); *American Education* (1917); *The Quaker Colonies* (1918); and many articles on out-of-door life and field sports.

Fisher, WILLIAM ARMS (1861–), American editor, educator and musical composer, was born in San Francisco, Cal. He studied singing in England under Shakespeare, and theory, composition and orchestration in America under Horatio W. Parker and Dvořák. From 1897 to 1937 he was editor and publishing manager for the Oliver Ditson Company. He composed many songs, anthems, and part-songs and edited with original accompaniments a volume of *Irish Songs,* and one of *Negro Spirituals.* Editor of *The Musicians' Library, The Music Students' Library, A Course of Study in Music Understanding,* and *The Music Students' Piano Course.*

Fisher, (WILLIAM) MARK (1841–1923), American artist, was born in Boston, Mass. He studied at the Lowell Institute in that city, at first giving his attention to portraits and figure subjects, but afterward devoting himself to landscape and animal painting. At the age of twenty he entered Gleyre's studio in Paris. On his return to Boston he found so little encouragement that in 1877 he settled in England. He was elected an associate of the Royal Academy in 1911. His *Farmer* (New English Art Club, 1900) is a good example of his favorite pastoral scenes, characterized by vigorous and realistic handling, strong, rich color, and a careful study of light and atmosphere.

Fisher, FORT, a former fort on Federal Point, near the mouth of the Cape Fear River, about 18 miles south of Wilmington, N. C. It was important during the Civil War for the Confederate defense of Wilmington harbor, which late in 1864 was the only port along the Atlantic Coast left open to Confederate blockade runners. A naval force under Admiral Porter and a land force under Gen. B. F. Butler failed in an attempt to capture it, Dec. 24 and 25, 1864, and a second attempt was made the following January. The naval force, as in the first attempt, was commanded by Porter, and the land force by General Terry. The fleet (60 war vessels and gunboats) bombarded the fort with great effect on Jan. 13, 14, and 15; on the 15th the land force attacked, assisted by about 2,000 sailors and marines, and the Confederates were forced to capitulate. The Confederate force consisted at the outset of about 2,500 men (under General Whiting), of whom about 500 were killed or wounded and the rest captured. The Federal loss in killed and wounded was probably less than 1,200. Consult Johnson and Buel's *Battles and Leaders of the Civil War* (4 vols.).

Fisheries.—The term 'fisheries' includes catching, taking, harvesting, cultivating, farming, and propagating aquatic products; and the term 'aquatic products' includes fish, shellfish, seaweeds, and other aquatic forms of animal and vegetable life.

Thus the commercial fisheries are principally concerned with the making available of foodstuffs from one of their two great sources—the land and the sea. The true importance of the sea as a self-perpetuating natural resource for these foods cannot be accurately measured. Approximately three-fourths of the earth's surface is covered by water and the exploration of this vast area in a medium unnatural to man is difficult. The many species of aquatic life not previously known to science, which are discovered each year, is evidence of the great number yet to be identified, and it is true that the commercial exploitation of seafoods on any considerable scale is confined to a relatively few species.

Aquatic products have been utilized by man since phehistoric times. Marine transportation probably owes its origin to the crude craft designed by early man for fishing. Many maritime nations trace their early ascendancy to their sea fisheries. Thus Britain's later dominance on the sea had its origin in her fisheries in the North Sea.

Marine Fisheries.—The world's marine fisheries are largely confined to those higher plateaus and elevations of the ocean's floor known as 'fishing banks,' and to coastal waters. Commercial fishing apparatus thus far developed is not designed for use at extreme depths; thus the marine fisheries are conducted principally on the continental shelves of the world and on the off-shore fishing banks.

The major groups of aquatic products which are used for food are: fish, mollusks, crustacea, and marine algae.

The herring family includes in excess of 150 species. Herring has furnished the raw material of important fisheries in the North Sea for more than a thousand years and today is more prolific as a source of the world's seafood than any other variety of fish. The sardine industries of the United States, Japan, Norway, France, Spain, Portugal, and other countries are based on the herring. The common sea herring is a surface feeding fish which comes inshore to spawn.

There are about 140 species of cod, haddock, and similar forms known as the 'gadoid' fishes. They are found in both the Pacific and Atlantic Oceans in the north temperate zone. The cod fisheries of the North Atlantic were largely responsible for the early prosperity of New England and have furnished the raw material for important fishery industries on both sides of the Atlantic Ocean for many centuries.

The Pacific salmon is hatched in fresh water, after which it migrates to the sea where the greater part of its adult life is

Fisheries

spent. After from three to six years, however, it returns to the same stream or lake of its origin to spawn and then to die. Most of the commercial catch is made at the mouths of the streams when they are migrating to the spawning grounds. Due to the high unit value of the salmon, the fishery is of great importance. The principal commercial fisheries for this species are conducted in Alaska, British Columbia, the North Pacific Coast of the United States, Japan, and Siberia.

Mackerel are distributed widely in the waters of the

for such fish as halibut, which are taken in both the North Pacific and North Atlantic Oceans; those for the many species of flounders which are widely distributed over the world; and those for menhaden. The latter species is taken on the Atlantic Coast of the United States where it is used almost exclusively for reduction into fish scrap and meal for fertilizer or an animal feedstuff, and into oil.

The oyster is the best known and most productive among the world's edible mollusks. The leading country in the yield of oysters is the United States,

ster, is native to tropical and sub-tropical regions, such as South Africa, Australia, Mexico, the West Indies, and Florida and California in the United States.

There are many species of shrimp distributed over the world, but the largest annual yield of this crustacean is taken in the fisheries of the United States. The fisheries in this country are concentrated principally in the South Atlantic and Gulf States where the bulk of the catch is made in otter trawls. Other countries contributing considerable volumes of shrimp to the world's catch are China,

Courtesy Biloxi Chamber of Commerce — Photo by Anthony V. Ragusin

SHRIMP TRAWL BOATS IN BACK BAY, BILOXI, MISSISSIPPI

north temperate zone, important catches being made each year in waters adjacent to Japan, the United States, Canada, France, Spain, Portugal, Norway, Sweden, England, and China. Mackerel feed at the surface and are taken almost exclusively by means of nets.

Tuna, like herring and mackerel, have a wide distribution. They are highly prized because of their large size and adaptability for canning. The albacore is the smallest of the tunas, rarely exceeding 80 pounds in weight. The bluefin tuna, which is the largest, frequently weighs several hundred pounds and specimens are occasionally taken weighing more than a thousand pounds. The tuna fisheries of Japan and the United States are of especial importance. Considerable quantities also are taken by fishermen in the countries bordering on the Mediterranean Sea.

Other important commercial fisheries of the world are those

where they are found in every seacoast State from Massachusetts to Texas and in Washington, Oregon, and California. Considerable quantities also are taken in France and Japan. The oyster is one of the few fishery products which lends itself to 'farming.' Many oyster grounds are privately controlled, and the oysters are planted, cultivated, and harvested much as are land crops.

Among the crustacea group of seafoods the lobster, shrimp, and crab are outstanding. The Northern lobster is produced in the largest volume on the Atlantic Coast of Canada, although considerable quantities are taken each year on the coast of the United States from the Middle Atlantic States northward. Smaller yields result each year from the fisheries for this crustacean on the coasts of several European countries.

The sea crawfish, or spiny lobster, which does not have the large claws of the Northern lob-

Japan, Mexico, Netherlands, and France.

Crabs of many varieties are represented in the commercial fisheries for crustacea. The outstanding crab-producing countries in order of their importance are the United States, Japan, China, Portugal, and the United Kingdom. In the United States the fishery is based principally on the blue crab and is concentrated in the States along the Atlantic and Gulf Coasts from Maryland to Texas.

Marine algae, or sea weeds, consist of a large range of varieties. In Japan, algae are held in such high esteem as a food that the natural growth is insufficient for the local requirements, and the Japanese have resorted to cultivation to augment the supply. No less than 25 species of marine algae are eaten by the Japanese. The two most important cultivated seaweeds of Japan are 'Amanori' and 'Funori.' Irish moss and dulse are used as food in Europe and

America. The Hawaiians use about 40 species of algae as food.

Methods of Fishing.—While scores of different types of fishing apparatus are used in the capture of the world's harvest of the hundreds of species of commercially important fish and shellfish, virtually all of these fishing gears fall in four general classes when grouped according to their principles of operation. These are 'enclosures,' 'gill nets,' 'hooks and lines,' and 'spears.' A fifth method of capture of considerable importance might be termed 'by hand' or 'gathering.'

The 'enclosure' group of fishing apparatus, accounting for the bulk of the world's catch of fish, includes the purse seine which is used extensively in the capture of salmon, mackerel, tuna, pilchard, and other surface swimming fish. The purse seine consists of a wall of webbing which is held vertical in the water by a series of corks at the top of the net and leads at the bottom.

The haul seine is similar in appearance to the purse seine, but it is used in shoal water near shore. The seine is laid parallel to the shore with the school of fish between the net and the shore; then the net is hauled ashore by drawing in the two ends. Many species of shore fish are taken with haul seines.

Included among the enclosure types of gear are several types of bag-like devices which are towed on the ocean floor behind fishing craft. The most important of these is the otter trawl. This apparatus is used extensively from motor-powered vessels on the North Atlantic fishing banks where they have largely supplanted the picturesque schooners of earlier days which operated trawl line gear. The otter trawl is essentially a conical bag of webbing with leads on its bottom edge and floats at the top. A board is fixed at either side of the net in such a manner that the passage of these boards through the water holds the net apart. After the otter trawl is dragged along the bottom for thirty minutes or more it is hoisted aboard the vessel and the catch removed. The otter trawl is important in the capture of such bottom-feeding fish as cod, haddock, pollock, rosefish, and flounders. It also has been adapted to the shrimp fishery to the point where virtually the entire catch of shrimp in the South Atlantic and Gulf States of the United States is taken by this gear. Other apparatus of somewhat different appearance but operated in a similar manner to the otter trawl are dredges, used for clams, oysters, scallops, and mussels; and scrapes, used in the taking of crabs.

The gill net involves a second principle of fishing operation. This net, like several of the enclosure types of nets, consists of a wall of webbing held vertical by the weight of leads at the bottom and supported by floats at the top. The capture of fish in these nets is based on their swimming blindly into the net and projecting their heads through the spaces in the webbing. The mesh is of a size which prevents the body of the fish from passing through. When the fish attempts to withdraw its head the twine of the net passes forward and under the gill covers, thus preventing its escape by either forward or backward movement. Various sizes of mesh are used in gill nets, depending upon the variety and size of the fish which are sought. Since the nets may be fished at any depth, they are very effective in the taking of a wide range of species, whether they be surface or bottom feeders. Gill nets are of several different types, according to the method of operation. Stake gill nets are fixed in position by means of stakes; anchor gill nets are held in place by means of anchors; and drift gill nets are floated from the fishermen's boat by permitting them to move with the tide or current.

The hook and line principle of the capture of fish is an important one in the world's commercial fisheries. It is true that technological improvement has displaced the hook and line in some fisheries, of which the best example is the supplanting of this gear in the North Atlantic bank fishery by the otter trawl. However, the hook and line is well adapted to the capture of some of our larger fish, and in fishing in waters where the bottom is too rough for the use of trawls or other similar moving gear. Thus, lines are most important in the capture of such species as halibut, tuna, and red snapper, and considerable quantities of salmon are taken with this gear.

The fourth principle of taking fish is exemplified by the spear or harpoon. With the exception of the harpoon gun used in the whale fishery, spears and harpoons have varied but little in operation or design from the time of primitive fisheries. In the modern use of the harpoon gun a grenade harpoon is shot into the whale from a cannon located in the bow of the vessel. The head of the harpoon is filled with powder which is exploded by a time fuse, or other means, within the body of the whale. If the shot has been well placed, this gear is very efficient in its killing effect. Hand operated harpoons are used in the capture of such species as swordfish and tuna. Spears are used in the taking of eels and many varieties of smaller fish.

It is rather surprising that important catches of inactive or immobile seafoods are made each year without the use of any apparatus of capture. Thus considerable quantities of oysters, clams, scallops, mussels, crabs, terrapin, and other seafoods are harvested by a gathering or hand process. This method of the capture of lower forms of fish life is practised especially at low tide.

Sea Fisheries of the World.—In a typical year, the commercial fisheries of the world yield about thirty billion pounds, with a value to the fisherman of three quarters of a billion dollars. By far the greater part of this enormous yield is concentrated in the north temperate zone. This zone offers unusual conditions for successful fisheries. Here extensive river systems carry to the sea tremendous quantities of water which is loaded with organic and inorganic nutrients for maintaining fish life; there are extensive continental shelves, bays, banks, and islands which furnish conditions ideal for fish life; and in this zone exploitation of the fisheries has been most intensive.

In terms of the value of the catch in a normal year the fisheries of the United States (including Alaska) exceed those of any other country. Following in order are the fisheries of Japan, the Union of Soviet Socialist Republics, the United Kingdom, Canada, and Germany. The catch in any of these countries exceeds a billion pounds in a normal year.

In the United States the catch consists of nearly two hundred species or closely related groups of species. One of these, the California pilchard, contributes nearly one-third of the volume of the catch of the United States, and nine species—pilchard, salmon, menhaden, sea herring, haddock, mackerel, cod, tuna, and shrimp—make up four-fifths of the catch. Due to the higher unit value of some species taken in less volume, the total value of the principal species to the fisherman does not fall in the same order. Thus the yield of the ten principal species in a typical year in order of their importance with respect to value is as follows: salmon, oysters, pilchard, tuna, haddock, shrimp, halibut, cod, clams and crabs. The more important seafoods of Japan are sardines and herring, sea bream, tuna, bonito, floun-

Fisheries

ders, salmon, shrimp, and sea weeds.

River and Lake Fisheries.—Although much more restricted in total area than marine waters, the world's streams and lakes are important sources of fish. The most productive of these are on the North American continent, although the sturgeon fisheries of the inland waters of the Soviet Union are of importance in local as well as world trade. The coastal streams of both the Atlantic and Pacific coasts of North America support important fisheries for anadromous species, that is, those which live their adult life at sea but migrate into the fresh waters of coastal streams to spawn. Among such species the salmon of the Pacific Coast is the most important and best known. Other well-known anadromous fishes are the shad and striped bass of both coasts, and the river herring of the Atlantic Coast. A species directly opposite in its reproductive habits is the common eel, which lives its adult life in fresh water but migrates to the Sargasso Sea in salt water to spawn. Our coastal streams produce quantities of other true fresh-water species such as perch, catfish, and carp.

The fisheries of the United States and Canada in the Great Lakes normally produce about one and one-quarter million pounds of fish each year, the outstanding varieties being blue pike, lake herring, lake trout, and whitefish. Important catches of fresh-water fish also are made in the interior lakes of Canada and in the Mississippi River and its tributaries. The methods of capture employed in these inland fisheries are much the same as those used for marine species. Thus, such apparatus as gill nets, haul seines, trap nets, pound nets, fyke nets, and lines are familiar in these fisheries.

As salt-water varieties of fish are highly esteemed in our seacoast towns and cities, so are fresh-water varieties greatly prized in inland cities. A survey made for the six months period from September 1938 to February 1939, inclusive, showed that three pounds of fresh-water fish are received in Chicago to every two pounds of salt-water fish.

A mollusk of considerable importance in the fisheries of the Mississippi Valley is the fresh-water clam or mussel. It is not used for food, but its hard shell, which takes a high polish, is the raw material for the important pearl-button industry of that section.

Minor Fisheries.—There is a large variety of seafoods which are of importance in restricted areas or may have limited distribution on a wider scale. The shad enters many streams of the Atlantic Coast each spring on its way to fresh water to spawn, and it is taken in considerable quantities by net fishermen. Late in the 19th century this species was introduced on the Pacific Coast and today its capture furnishes important fisheries in the Sacramento and Columbia Rivers.

Because of their unusual flavor and texture, and their consequent high price, pompano are much sought, especially along the coast of Florida. They are taken almost entirely by nets.

Courtesy U. S. Bureau of Fisheries

Purse Seining for Salmon, Alaska.

Many craft in the New England bank fisheries carry harpoons and other necessary equipment throughout the late spring and summer months for the capturing of swordfish when they are sighted. The red snapper and grouper fisheries of the Gulf of Mexico are of considerable importance to several fleets of handline vessels operating from Gulf ports.

The mullet fisheries are of importance in Florida where they are captured largely by gill nets and haul seines. Many varieties of shore fish such as spot, sea trout, croaker, sea bass, and scup are taken in nets along the Atlantic Coast. Limited catches of turtles and terrapin are made. Several varieties of scallops furnish fisheries on both coasts of the United States.

Fishing Laws.—The protec-

Paul's Photos, Chicago

BRITISH COLUMBIA SALMON ARRIVING AT THE CANNERY

Courtesy Canadian National Railways

FISH DOCKS AT LOCKPORT, NOVA SCOTIA

Fisheries

tion of fish from depletion is a responsibility of Government. Terrestrial foods and the land on which they grow are usually privately owned, and individual enterprise can be depended upon to maintain adequate breeding stocks, but since our fish and the water in which they live are seldom privately controlled, fishermen cannot normally be expected to take from the water only surplus fish and leave stocks adequate to perpetuate the species. Thus it becomes the duty of Government to enact suitable legislation to protect our fishery resources from extinction. That Government has not always done this is evidenced by our many depleted or virtually extinct fisheries of which examples are the sturgeon in many rivers of the United States, the cisco of Lake Erie, and the shad of the Atlantic Coast.

Several methods are employed to conserve fishery resources. The specific waters, wherein the species believed to be in danger live, may be closed at times of spawning, or for such periods as it appears will adequately protect the species; certain types of fishing gear may be prohibited; or the quantity of gear to be fished may be fixed. These methods for the protection of aquatic life are dependent for their effectiveness on suitable legislation. Thus the fisheries of territorial waters are most easily controlled since a single government usually has jurisdiction over considerable expanses of such aquatic areas. However, in the United States the jurisdiction of fishing activities in territorial waters rests with the individual States and as a result there is wide variation in the extent and method of protection of fishery resources. In the Territory of Alaska, however, the Bureau of Fisheries of the United States is the managing agency and it prepares and enforces laws and regulations for the protection of the important salmon and other fisheries. Except for certain rivers, commercial fisheries are prohibited in Alaskan streams and within five hundred yards of their mouths. In a number of the streams weirs are operated for counting the number of salmon which ascend to the spawning grounds. Data thus obtained are compared with the commercial catch to assure the escapement of at least 50 per cent of each particular run of fish to the spawning ground. Opening and closing dates for fishing seasons are fixed in various districts and other restrictions are promulgated adequately to protect this important fishery resource.

Where the fisheries of two countries draw from the same source, treaties are sometimes most satisfactory instruments of conservation. An outstanding example is the treaty between the United States and Canada which deals with the Pacific halibut fishery. Shortly after the World War this fishery was being depleted rapidly, but the research staff of the Commission developed corrective regulations based on careful scientific investigation. The result has been that depletion in this fishery has been arrested and the stock on the banks increased. A staff of scientists conduct continuing scientific studies of this fishery, and regulations are changed from time to time to conform with conditions.

The Care and Disposition of the Catch.—Fish are highly perishable; consequently, the greatest care must be taken in handling the catch. Except in cold weather, ice or other refrigeration must be applied to fish shortly after capture if they are to maintain their quality, and thereafter they must be kept almost continuously under refrigeration until they are processed or consumed. Thus, refrigeration usually starts on board the fishing vessel, unless the fishing trip is very short or the weather is cold. After arrival at port, the catch may follow several courses; some may be delivered to local dealers; a part may be shipped on ice; a portion may be delivered to canners, smokers, salters, or packagers; and if the catch is heavy, a considerable part may be frozen and held in cold storage for later disposal.

Fisheries are notably seasonal and erratic. Demand fluctuates with the popular conception of Friday and the Lenten season being reserved for fish consumption. Thus, the storage of frozen fish is of greatest importance to producers, middlemen, and consumers alike.

The development of 'quick freezing' has been especially beneficial to the fishery industry. Rapid freezing at low temperature prevents the formation of ice crystals, similar to long sharp needles, in the flesh which upon defrosting may rupture the membranes and permit the juice to escape.

The packaging of fresh and frozen fish has been an outstanding development in the marketing of fish in the first part of the twentieth century. Packaged fish usually are either fillets or steaks. Fillets consist of the two fleshy sides of medium-sized fish, with head, tail, and fins removed. They are usually boneless. Steaks are cross-cuts from larger species. They have a minimum of bones. These fillets and steaks may be wrapped individually with the brand name possibly appearing on the wrapper. This more recent practice in the preparation of fish for sale is based on the recognition of the tremendous importance of small families in the consumer trade, as well as on the understanding of the aversion that many housewives have for cleaning fish.

Foods of aquatic source are notable for their wide range of species of varying texture, taste, and form. This range is further broadened by the numerous different methods which processors have developed for preparing these commodities for the consumer. Thus, in addition to the fresh and frozen condition, the same commodity may be available to a housewife as a smoked, kippered, salted, or canned article, or it may be prepared in other ways. Not only do these additional processes supply commodities to the housewife of different flavors and for expanded uses, but these methods of preserving furnish to the producers of these commodities means of utilizing large seasonal supplies of fish that might otherwise become economic waste.

These several methods for the preserving of the catch have had a most important effect on the marketing of fishery commodities since commodities of quality from the marine areas can now be marketed in interior regions, and those produced in inland streams and lakes can be consumed in coastal regions. Each year large quantities of fish and shellfish also are marketed in foreign trade. For instance, the United States annually exports millions of pounds of fresh oysters; frozen salmon and shrimp; salted salmon and herring; canned salmon, sardines and shrimp; and other aquatic products. The United States receives in return from foreign countries millions of pounds of fresh and frozen salmon, freshwater fish, haddock, halibut, swordfish, smelt, tuna, sea herring, crabs, and lobsters; salted cod, haddock, herring, and mackerel; canned sardines, tuna, anchovies, and crabs; as well as scores of other fishery commodities.

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Also refer to the sections dealing with *Fisheries* in the articles on the various countries in this work; also the articles on the different fish, and the following headings: PISCICULTURE; SEAL FISHERIES; WHALING; SPONGE; NORTH SEA; ATLANTIC FISHERIES ARBITRATION.

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Fisheries Society, AMERICAN, an organization founded December 20, 1870, to promote the cause of fish culture and fisheries, and for the discussion of questions of a scientific or practical character regarding fish. The society holds an annual meeting and publishes *Annual Transactions.*

Fisheries, U. S. Bureau of, a bureau of the U. S. Department of the Interior since July 1, 1939. After operating for thirty-two years as an independent commission known as the United States Commission of Fish and Fisheries, it was placed in 1903 in the newly established Department of Commerce and Labor as the Bureau of Fisheries. By an order of the Secretary of Commerce in 1905, the bureau was charged with the administration of the salmon fisheries of Alaska. Subsequently by law this jurisdiction was extended to all the fisheries of Alaska. In 1908 the Alaska fur seal service was transferred from the office of the Secretary of Commerce to the Bureau of Fisheries. In 1913 when the Departments of Commerce and Labor were separated, the Bureau of Fisheries remained in the Department of Commerce. The bureau is primarily concerned with three broad functions: (1) the conservation of our fishery resources; (2) replenishment of supplies of aquatic forms that are in danger of exhaustion; and (3) economic utilization of the nation's harvest of fishery commodities. It conducts research work in many scientific fields and publishes annual and periodic reports and bulletins on pertinent subjects.

Fisher's Hill, a precipitous bluff in Frederick county, Va., about 2 miles south of Strasburg. During the last campaign of the Civil War in the Shenandoah Valley, it was the scene, Sept. 22, 1864, of a battle between about 20,000 Federals under General Sheridan and about 12,000 Confederates under General Early, who had retreated hither after the battle of Opequan or Winchester (Sept. 19). Sheridan attacked Early both in front and in the rear and completely defeated him, the Confederates fleeing in great confusion from the field. The Federal loss was about 500; the Confederate (including prisoners), about 1,300.

Fisher's Island, an island at the eastern entrance of Long Island Sound, in Suffolk county, N. Y. It is separated from Connecticut by Fisher's Island Sound, is about 8 miles long, one mile wide, and about 4,000 acres in area. Fort H. G. Wright, at the eastern end of the island, 7 miles southeast of New London, Conn., is headquarters of the coast defenses of Long Island Sound.

Fish Hawk. See OSPREY.

Fish-hook, a barbed instrument attached to a line and used for catching fish. Specimens formed of bronze, horn, and fragments of shell, but curiously similar in shape to a modern hook, have been found in many places in company with other remains of prehistoric man. Fish-hooks are now made of soft steel wire. Small hooks are usually attached with fine silk to pieces of gut. Larger hooks, and those to which artificial flies are fastened, are generally eyed, so that the gut, gimp, or line may be tied directly to the hook. The modern fish-hook is for most purposes bent to a spiral curve, the sharpest portion of which terminates in a straight, barbed point parallel to the shank. Besides single hooks of all sizes, there are double or treble hooks on one shank, single hooks placed tandem fashion on the same trace, and combinations of these two systems for holding live and dead bait, spoons, spinners, and many other forms of artificial allurement. See ANGLING.

Fishing. See ANGLING; FISHERIES.

Fishing Creek, BATTLE OF, a minor engagement of the American Revolution, fought (Aug. 18, 1780) on Fishing Creek, S. C., about 2 miles above its junction with the Catawba, between an American force under Colonel Sumter and a British force under Colonel Tarleton. The Americans were completely surprised and were thoroughly routed, Tarleton capturing about 300 of Sumter's force, killing or wounding over 50 more, and releasing about 100 British prisoners in the American camp, besides capturing a large supply of small arms. Tarleton's losses are not definitely known, but were relatively small. The battle of Mill Springs (q. v.) of the Civil War is also sometimes known as the battle of Fishing Creek.

Fishkill Landing. See BEACON.

Fish Lice, a general name for the parasitic forms of the order Copepoda (q. v.), forming the division Epizoa (q. v.). The name is also applied to certain of the isopods which have the same parasitic habit, and belong to the tribe of Flabellifera (q. v.).

Fish River, GREAT. See GREAT FISH RIVER.

Fisk, CLINTON BOWEN (1828–90), American soldier and philanthropist, was born in Greggsville, N. Y. After acquiring a competence in business in Michigan, in 1859 he established himself in St. Louis. He volunteered for the Union army in the Civil War, and was brevetted major-general of volunteers in 1865 for distinguished services. He subsequently interested himself in the amelioration of the condition of the colored race, was assistant commissioner of the Freedmen's Bureau in Kentucky and Tennessee under Gen. O. O. Howard, and helped to organize Fisk University in Tennessee. He gave active service to many religious and reform movements, and was for many years president of the board of Indian commissioners. He was Prohibition candidate for president in 1888.

Fisk, JAMES, Jr. (1834–72), American broker and stock speculator, was born in Bennington, Vt. He engaged in his father's business of peddling on an extensive scale in rural districts and at length became a member of the firm of Jordan and Marsh of Boston. He amassed considerable property during the Civil War by an astute policy in the handling of government contracts, and, it was rumored, by the no less lucrative enterprise of smuggling cotton through the lines. Subsequently he entered the field of stock speculation in New York City. Retained by Daniel Drew in the war with Cornelius Vanderbilt for supremacy in the Erie Railroad, he secured for himself the office of vice-president of that road under the presidency of Jay Gould. A system of

wholesale bribery, established in connection with the projects of the road, entangled courts, legislators, and Federal officials, but came to an end with an ill-advised attempt to influence even President Grant, in connection with the designs on the gold supply, and with the memorable panic of 'Black Friday' in 1869. Three years later Fisk was shot and killed in a quarrel with E. C. Stokes, a business associate.

Fisk, WILBUR (1792–1839), American clergyman and educator, was born in Brattleboro, Vt. He was graduated (1815) from Brown University, became a local preacher of the Methodist Episcopal Church in 1818, and the next year was admitted to the New England conference on probation. He was pastor of the M. E. Church in Charlestown, Mass., and principal of the Wesleyan academy at Wilbraham, Mass., and was particularly active in bringing about the organization of Methodist Episcopal educational institutions in the United States. On the establishment of Wesleyan University at Middletown, Conn., in 1831, he was made president, his term of office which lasted until his death being characterized by rapid development. He took a strong interest in temperance and other reforms, and was an advocate of the colonization of Negroes. He published *The Calvinistic Controversy* (1837), and *Travels in Europe.*

Fiske, AMOS KIDDER (1842–1921), American journalist, born in Whitefield, N. H. He was graduated in 1866 from Harvard, and two years later was admitted to the N. Y. bar. He soon turned his attention to letters, and in 1869 joined the staff of the N. Y. *Times,* with which he was associated until 1872, and again from 1878 to 1897. From 1874 to 1878 he was on the Boston *Globe,* and in 1903 he became associate editor of the *Journal of Commerce.* Besides much work for the *American* and *Annual Cyclopædias,* he published *Midnight Talks at the Club* (1890); *The Myths of Israel* (1897); *The Story of the Philippines* (1898); *The Story of the West Indies* (1899); *The Great Epic of Israel* (1911); *Honest Business* (1914); *The Modern Bank* (new ed., 1919).

Fiske, BRADLEY ALLEN (1854–), American naval officer, inventor, and author, was born in Lyons, N. Y. He was graduated from the U. S. Naval Academy in 1874; distinguished himself at the Battle of Manila Bay; became captain in 1907, and rear-admiral in 1911. He is best known for his successful naval inventions; the most important of which are the naval telescope sight, which did more than any other single agency to make possible the accurate naval gunnery of to-day, and the torpedoplane. His last duty in the U. S. Navy was as *Aid for Operations,* during which he was instrumental in establishing a General Staff for the Navy under the name of Office of Naval Operations. He resigned from this position in 1915. Admiral Fiske was elected president of the U. S. Naval Institute at eight successive elections. He was awarded a gold medal by the Franklin Institute in 1893 for his invention of the electric range finder, and the gold medal of the Aero Club in 1919 for his invention of the torpedoplane. He published *Electricity in Theory and Practice* (1884, 10 eds.); *War Time in Manila* (1913); *The Navy as a Fighting Machine* (1916); *From Midshipman to Rear-Admiral* (autobiography, 1919); *The Art of Fighting* (1920); *Invention* (1921); also numerous articles on electrical and naval subjects.

John Fiske.

Fiske, CHARLES (1868–), Protestant Episcopal bishop, was born at Brunswick, N. J. and was educated at St. Stephen's College, Annandale, N. Y. and at the General Theological Seminary in New York City, receiving subsequently various degrees from Syracuse University, Hamilton College and Hobart College. He became a deacon in 1896 and a priest the following year, and held pastorates in Westfield, N. J., Baltimore, Philadelphia, Somerville, N. J. and Norristown, Penn. In 1915 he was consecrated bishop coadjutor of Central New York and in 1923 he became bishop of that diocese. He retired in 1936 and thereafter devoted himself to the work of special lecturer at the College of Preachers at Washington and at the Philadelphia Divinity School and to the writing of books on theological subjects.

Fiske, DANIEL WILLARD (1831–1904), American scholar and educator, was born in Ellisburg, N. Y. He studied at Hamilton College, and in Europe, where he made a special study of Scandinavian languages; gave instruction in English and lectured on American literature in the University of Uppsala, Sweden; and from 1849 to 1852 was associated with the Astor Library in New York, gathering its collection of Icelandic books. He held the chair of North European languages and chief librarianship at Cornell from 1868 to 1871, and subsequently resided in Florence, Italy. He bequeathed to Cornell his fine library, including notable collections of works on Dante, Petrarch, and on Icelandic literature, with an endow-

ment for its maintenance. He published several works on chess and edited the *American Chess Monthly* (1857–60).

Fiske, John (1842–1901), American philosopher and historian, only child of Edmund Brewster Green (d. 1852), was born in Hartford, Conn., and on his mother's second marriage, in 1855, adopted the surname of his great-grandfather. He was remarkably precocious as a child, and was graduated from Harvard in 1863 and from the Harvard Law School in 1865. He embarked, however, on a literary career, after being connected with a single case, which he won for his client.

He was lecturer on philosophy at Harvard in 1869, instructor in history there in 1870, and assistant librarian from 1872 to 1879. He delivered numerous public lectures, chiefly on American history, to large audiences throughout the country, and lectured also at University College, London (1879), and at the Royal Institution (1880). After 1884 he was non-resident professor of American history at Washington University, St. Louis.

Fiske's first essays were published while he was an undergraduate; and he was thereafter a prolific writer. Early fascinated by the works of Darwin and Spencer, he published (1874) his *Outlines of Cosmic Philosophy,* his principal contribution to philosophical literature and an admirable exposition of the theory of evolution. 'He illuminated the subject in a thousand ways, and contributed to it at least one markedly important suggestion in his theory of the influence which prolonged infancy exercised upon social development' (Perry). After 1885 his publications had to do almost exclusively with American history, the substance of most of his books being first given in the form of public lectures.

To the interpretation of history Fiske applied his belief in evolution, and in his writings and lectures there was always a note of optimism—an underlying conviction that things were growing better. As a writer, he was a master of exposition, and all that he wrote was admirably clear and lucid. Though a man of profound learning and of indefatigable industry, he was not primarily an historical investigator, a student of original sources, but he utilized with great skill the monographic work of others, and was essentially—and in the best sense—a popularizer.

In addition to his *Cosmic Philosophy,* his publications include: *Myths and Myth-makers* (1872); *The Unseen World, and Other Essays* (1876); *Darwinism and Other Essays* (1879); *Excursions of an Evolutionist* (1883); *The Destiny of Man Viewed in the Light of His Origin* (1884); *American Political Ideals* (1885); *Critical Period of American History, 1783–89* (1888); *The Beginnings of New England* (1889); *The American Revolution* (2 vols. 1891); *The Discovery of America* (2 vols. 1892); *Old Virginia and Her Neighbors* (1897); *The Dutch and Quaker Colonies in America* (1899); *Through Nature to God* (1899); *The Mississippi Valley in the Civil War* (1900); *Life Everlasting* (1901); *Essays Historical and Literary* (2 vols. 1902); and *New France and New England* (1902). Consult Perry's *John Fiske.*

Fiske, Minnie Maddern (1865–1932), American actress, was born in New Orleans, La. Dec. 19, 1865 and died at Hollis, Queens Borough, New York City, Feb. 13, 1932. Her father was Thomas W. Davey, a theatrical manager. She was named Mary Augusta but she took her mother's maiden name of Maddern for her stage name. She began her stage career of upward of 60 years as a baby, and under the tuition of her mother she became proficient in children's parts. At twelve she played Françoise in *Richelieu* and at sixteen appeared as a star in a play called *Fogg's Ferry.* In 1890 she married Harrison Grey Fiske, editor of the *Dramatic Mirror,* who subsequently attained to a position of distinction as a theatrical writer and producer.

The high integrity of Mrs. Fiske's character, combined with a keen sense of the dramatic, broad sympathies, and a fine understanding of human problems made her one of the most famous figures of her day as a woman and as an actress. She gave her support to the promotion of a wide range of activities, including characteristically causes for the relief of suffering among children and animals. Her success on the stage was constant. Her most popular roles were perhaps *Becky Sharp, Tess of the d'Urbervilles,* and *Leah Kleschna.* Among the other plays in which she made notable appearances were *Madam Sand, Erstwhile Susan, Doll's House, Hedda Gabler, The Rivals, Mrs. Bumpstead-Leigh,* and *Ladies of the Jury.*

Fisk University, a co-educational institution for Negro students, located at Nashville, Tennessee, was founded in 1865 by the American Missionary Association. It became an independent institution in 1912 with a self perpetuating Board of Trustees. It was opened in 1866 in the Federal Hospital Army Barracks and ten years later moved to the present site upon which Jubilee Hall had been erected with money earned by the Jubilee Singers in New England and Europe. The University is approved by the Association of American Universities and offers work leading to the Bachelor of Arts and the Master of Arts degrees.

Fismes, fēm, town, France, in the department of the Marne, is situated at the confluence of the Ardre and the Vesle; about 17 miles northwest of Rheims. Population about 3,000.

In the World War Fismes was occupied by the Germans, and was used by them as an important depot of supplies. In the course of the Second Battle of the Marne (see Marne, Battles of) it was entered by American troops on August 4, 1918. After seven hours of bitter fighting the German forces were routed by a terrific artillery bombardment and driven back twelve miles.

Fistula (Lat. 'a pipe'), a term used in surgery for an abnormal channel between a hollow viscus and the surface of the body, or between two hollow viscera. Common examples are *salivary fistula,* opening into a salivary duct; *genito-urinary fistula,* opening into some portion of the genito-urinary tract; *entero-vesical fistula,* between the intestines and the bladder; *vesico-vaginal fistula,* between the bladder and the vagina; *fistula in ano,* a tunnel from the bowel to the skin surface at some distance from the anus; biliary fistulæ may be produced by gall stones; umbilical fistulæ are common.

Fistulæ may be of inflammatory, traumatic, surgical, or neoplastic origin and congenital or acquired. *Treatment* is surgical. In salivary or urinary fistula all that is generally necessary is to restore the patency of the natural ducts, by passing instruments along them. Should a fistula, however, be situated where it is surrounded by muscular fibers, as at the orifice of the lower bowel, it is necessary to divide these, so as to leave the part at rest while nature repairs it. During the process of healing, care must be taken that the wound closes from the bottom, otherwise the cut surfaces are apt to reunite. This may be prevented either by stuffing the wound with lint, or by daily dilatation to break down any adhesions that may have formed. Stimulant applications are some-

times necessary to promote the healing process.

Fis'tular'idæ, a family of marine fishes, known also as FLUTE-MOUTHS, remarkable for the elongation of the front bones of the head into a pipe, bearing the small mouth at its apex. They live near the shore, and are widely distributed in the warm parts of the Atlantic and Indo-Pacific.

Fis'tuli'na, a genus of edible fungi, of which one species, the Beefsteak or Liver Fungus, *F. hepatica,* is common. This is a large, liver-like fungus usually found growing on old chestnut and oak trees. It is semicircular, of very regular outline, with a lateral stem, or none; its color red; its substance fibrous and fleshy, much resembling beetroot. It contains a large quantity of red juice. This species is much eaten in France. In Vienna it is cut in thin slices and eaten as salad, and is also cooked with meat.

Fit, a term applied to any seizure in which convulsions occur. Fits occur in such diverse conditions as epilepsy, hysteria, apoplexy, and uræmia (qq. v.). By a hyperbole the word has been used to describe uncontrollable emotions, such as temper, laughter, or tears. By a similar extension of meaning it has been applied to any symptom or illness, or even to mere restlessness; thus we talk of 'a fit of coughing.' Among primitive races fits were considered to be the result of demoniacal possession. The Scriptural unfortunates, who were 'possessed by devils' were probably epileptics. See FIRST AID.

Fitch, the fur of the Fitchew or Polecat (q. v.).

Fitch, EBENEZER (1756–1833), American educator, was born in Norwich, Conn. He was graduated from Yale, where he subsequently acted as tutor. In 1791 he became principal of Williamstown Academy, and when this institution developed into Williams College he held the first presidency. In 1815 he resigned and became pastor of the Presbyterian Church in West Bloomfield, N. Y., and held this charge until 1827.

Fitch, GRAHAM NEWELL (1809–92), American physician and public official, was born in Le Roy, N. Y. He studied medicine in Fairfield, and was a professor in the Rush Medical College at Chicago (1844–7), and subsequently in the Indiana Medical College. He was presidential elector for Indiana on three occasions, and from 1836 to 1839 was a member of the State legislature. He held a seat in Congress for a term, and from 1857 to 1861 was a United States Senator. During the Civil War he raised a regiment of volunteers and held a command as colonel at the capture of Fort Pillow, Memphis, Tenn., and St. Charles, Ark. He retired on account of wounds in 1862.

Fitch, JOHN (1743–98), American inventor, was born in East Windsor, Conn. He followed the trade of a silversmith for a time, and during the Revolution made considerable profits as an army sutler. After the war he was appointed a deputy surveyor for Kentucky, and in sailing on western rivers conceived the idea of navigating them by steam. In 1785 he laid before the American Philosophical Society of Philadelphia plans of an engine for the propulsion of a boat against the streams of rivers, with the result that a company was formed to construct his steamer. The *Perseverance* was launched on the Delaware River in 1787 and achieved the rate of progress of three miles an hour. It was improved later and its power so increased that it made 80 miles in one day. A company for the navigation of the Delaware proved a failure, and having vainly visited France in 1793 in the attempt to promote his invention Fitch returned to the United States in a destitute condition. Disheartened by his misfortunes, he committed suicide. His engine was the first double-acting condensing engine transmitting power by means of cranks.

Fitch, LEROY (1835–75), American naval officer, was born in Indiana. He was graduated from the United States Naval Academy and became midshipman in 1856. During the Civil War he served in the Mississippi squadron, and took part in the capture of Forts Donelson and Fisher, and in the engagement with the Confederate fleet at Memphis, Tenn. In 1863, as a lieutenant in command of the steamer *Moose,* he did notable service in frustrating Morgan's attempts to cross the Ohio, and in bringing about his ultimate capture. For this and many other gallant services he was promoted commander in 1870.

Fitch, RALPH (fl. 1583–1606), was the first Englishman known to have travelled overland to India (1583–91). He wrote the account of his adventures, published in 1599 by Hakluyt (*Navigations*). Surviving at least fifteen years longer, he assisted in establishing the East India Company (1601).

Fitch, WILLIAM CLYDE (1865–1909), American dramatist, was born in New York City. He was graduated from Amherst College (1886), and for a time lectured on English literature in New York, but soon turned his attention to play-writing. Beginning with *Beau Brummel* (1890) he composed a succession of plays, notable for their mastery of stagecraft, though perhaps not penetrating deeply into the philosophy of life. They include *Pamela's Prodigy, The Moth and the Flame, Nathan Hale, Barbara Frietchie, The Cowboy and the Lady* (performed in London), *The Climbers, The Last of the Dandies* (produced in London), *Major André, The Woman in the Case,* and *The City.*

Fitch'burg, city, Massachusetts, one of the county seats of Worcester county, on the Nashua River, and the Boston and Maine, and the New York, New Haven and Hartford Railroads; 23 miles north of Worcester, 50 miles northwest of Boston. Educational and philanthropic institutions include the Fitchburg State Normal School, the Wallace Free Library, the Burbank Hospital, Old Ladies' and Children's Homes, and a high school with a modern athletic field. Fitchburg is a thriving industrial city, having manufactures of motor trucks, automatic sprinklers, armor plate, awnings, castings, bricks, brooms, brushes, flour, lumber products, wagons, edge tools, fire-arms, machinery, textiles, clothing, paper products, shoes, and bicycles. Pop. (1940) 41,497.

Fitches. See VETCH.

Fittonia, fit-ō'ni-*a,* a genus of Peruvian evergreen shrubs belonging to the order Acanthaceæ. They are low-habited plants, with large heart-shaped leaves often veined with red or white.

Fitweed, an American species of Eryngium (q. v.).

Fitz, the Anglo-French word for son, of which the earlier form was *filz.* In early historical use Fitz was prefixed to the name of a parent; and the compound thus used has passed into a common surname, as Fitzpatrick, Fitzherbert, Fitzgerald.

Fitzalan. See ARUNDEL, EARLS OF.

Fitz'ger'ald, city, Georgia, county seat of Ben Hill county, on the Seaboard Air Line, and the Atlanta, Birmingham and Atlantic Railroads; 70 miles southeast of Macon. The Central Dixie Highway and the Jeff Davis Highway pass through the city. It has iron works, cotton and oil mills, a tobacco warehouse, tobacco redrying plant, and cotton compress. Pop. (1920) 6,870; (1930) 6,412.

Fitzgerald, LORD EDWARD (1763–98), Irish patriot, a

younger son of the duke of Leinster, was born in Carton Castle, near Dublin, Ireland. After his father's death he was brought up in France, but returned to England in 1779 to enter the army. He served with distinction in the American war, next sat for Athy in the Irish parliament, and was drawn to Paris by the Revolution. Here he renounced his nobility, and married Pamela (long believed to be a daughter of Madame de Genlis by *Egalité* Orléans; really a daughter of G. de Brixey and Mary Sims, born in Newfoundland). Returning to Ireland (1793), he joined the United Irishmen (1796), and went to France to arrange for a French invasion of Ireland. Soon after his return the plot was betrayed to the government, and Fitzgerald was seized, but resisted and died of his wounds.

FitzGerald, EDWARD (1809–83), English poet and translator, was born in Bredfield House, near Woodbridge. He went up to Trinity College, Cambridge, in October 1826, where Spedding joined him the next year, and where he formed fast friendships with Thackeray, W. H. Thompson, afterwards Master of Trinity, and John Allen, afterwards archdeacon of Salop.

The first forty-two years of his life passed in quiet reading and study, and it was not till 1851 that he published anonymously his dialogue on youth, *Euphranor,* which was followed by *Polonius* (1852). In the meantime he had been persuaded to take up the study of Spanish, and in 1853 he published a translation of six dramas of Calderón under his own name but an unfavorable (and undiscriminating) criticism appearing in the *Athenæum* caused him to withdraw this from circulation.

FitzGerald's interest in Persian literature dates from about 1853. Sa'di's *Gulistán* early attracted him by its quaint stories, and in 1856 he published an anonymous version of Jámi's *Salámán and Absál;* he also wrote, but never printed, an abridgment in verse of 'Attár's *Mantik ut tair.* The Persian poet who most interested him, however, from the time of his first seeing his works in 1856 in a MS. in the Bodleian Library, was Omar Khayyam (q. v.). FitzGerald at once recognized the beauty of the astronomer-poet's works and their names are now indissolubly linked together. His translation of the Rubaiyat, published anonymously in 1859, at first attracted little attention, but the later realization of its value led to the publication of four more editions before the translator's death.

Fitz-Gerald, JOHN DRISCOLL, II (1873–), American educator, was born in Newark, N. J. He was graduated from Columbia University (1895; PH.D., 1906), and studied in Berlin, Paris, and Madrid. He was successively tutor (1902–07) and instructor (1907–09) in Romance languages and literatures at Columbia University; assistant professor in Romance languages and literatures (1909–15), professor of Spanish (1915–25), professor of Romance philology (1925–29) at the University of Illinois; and from 1929 professor of Romance philology and head of the department of Spanish at the University of Arizona.

Fitzgerald, PERCY HETHERINGTON (1834–1925), Irish novelist, was born in Fane Valley, County Louth, Ireland. He was educated at Stoneyhurst and at Trinity College, Dublin. He was called to the Irish bar, and appointed crown prosecutor in Ireland, but went to England and entered upon a literary career, writing for *Household Words* under Dickens and Forster. His works include in addition to many novels, *The Royal Dukes and Princesses of the Family of George III* (1860); *Charles Lamb, His Friends, His Haunts, and His Books* (1865); *Life of David Garrick* (1868); *The Kembles* (1871); *The Life of George IV* (1881); *Life and Times of William IV* (1884); *Fifty Years of Catholic Life and Social Progress* (1901); *History of the English Stage* (1882); *Memoirs of Charles Dickens* (1914); *Worldlyman* (1914). He was also a sculptor of merit, having modelled busts of Carlyle and Dickens, bronze statues of Boswell and Dr. Johnson, tablets to Cardinal Manning and the Hon. Mrs. Percy Fitzgerald, and a pulpit for Palace St. Church.

Fitzgerald, THOMAS (1796–1855), American public official, was born in Germantown, Herkimer county, N. Y., of Irish parentage. He received a common school education, served in the war of 1812 with distinction, was subsequently admitted to the bar and practised in Indiana, where he became a member of its first legislature. In 1837 he was made a regent of the University of Michigan, and during 1848–49 was a United States senator. His best work was done on a commission which inquired into and succeeded in extinguishing the so-called 'wild-cat' banks. Towards the close of his life he was probate judge of Berrien county, Michigan, and a pillar of the Democratic party.

Fitzher'bert, MARIA ANNE, *née* SMYTHE (1756–1837), a Roman Catholic lady, to whom, after she had been a second time left a widow, the Prince of Wales, afterwards George IV, was secretly married (1785). This marriage, contracted without the king's consent, was invalid under the Royal Marriage Act of 1772, and was never publicly acknowledged. On the king's marriage to the Princess Caroline (1795) the connection was broken off for a time. It was afterwards resumed, and finally terminated in 1803.

Fitz-James, JAMES. See BERWICK, JAMES FITZ-JAMES, DUKE OF.

Fitzmau'rice, EDMOND GEORGE BARON (1846–1935), English diplomat, was educated at Eton and Trinity College, Cambridge. He sat in Parliament as M.P. for Calne from 1869 to 1885 and for the Cricklade division of Wiltshire from 1898 to 1905. From 1882 to 1885 and from 1905 to 1908 he was under-secretary for foreign affairs and in 1908–09 acted as Chancellor of the Duchy of Lancaster. He was created Baron Fitzmaurice of Leigh in 1906. His published works include *Life of William, Earl of Shelbourne* (1875–7); *Sir William Petty* (1895); *Life of Earl Granville* (1905); *Letters of the Abbé Morellet; Charles William, Duke of Brunswick;* and *Letters of Gavin Hamilton, the Art Collector.*

Fitzmaurice, HENRY PETTY. See LANSDOWNE.

Fitzpatrick, SIR CHARLES (1851–), Canadian jurist, was born in Quebec. He was crown prosecutor for Quebec in 1879. He was leading counsel in 1885 for Louis Riel (q. v.), who was tried and executed for high treason. In 1887 he was again crown prosecutor for Quebec. He was a member of the Quebec Assembly in 1890–6 as a Liberal, was elected to the Dominion Parliament in 1896, and was solicitor-general (1896–1902) in Sir Wilfrid Laurier's ministry. In 1901 he was appointed Minister of Justice, in 1906 chief justice of Canada, and in 1908 one of the British members of the International Arbitration Court at The Hague. He resigned as chief justice and was appointed lieutenant-governor of Quebec (1918–23).

Fitzpatrick, JOHN BERNARD (1812–66), American Roman Catholic bishop, was born in Boston, Mass. He was educated in the Boston Latin School, in Montreal, and in the Grand Seminary of St. Sulpice, Paris; was ordained at Boston in 1840; and in 1846 was appointed bishop. He erected a fine orphan asylum, a reformatory, a

hospital, and a college. A controversy with the Boston school board in 1854, which attracted wide attention, ended in a repeal of rules obnoxious to the pupils of his church. His administration aroused marked hostility. A Roman Catholic Church in Dorchester was blown up and a priest was outrageously treated.

Fitzroy, city, Victoria, Commonwealth of Australia; 2 miles northeast of Melbourne, of which it forms a suburb. Pop. 35,000.

Fitzroy, river, Western Australia, rises in King Leopold Mountains and flows west into King Sound. It is navigable for steamers for 100 miles from its mouth. The river was explored by Forrest in 1879; its source was discovered by Stokes in 1842.

Fitzroy, Robert (1805–65), English admiral, hydrographer, and meteorologist, was born in Suffolk. His first important work was that of surveying the coasts of Patagonia and Tierra del Fuego (1828–1830); and this work he was charged to continue on his re-appointment to the command of the *Beagle* (1831). On this voyage he was accompanied by Darwin, the two together publishing in 1839 a *Narrative of the Surveying Voyages of H.M.S. 'Adventure' and 'Beagle,'* vols. i and ii by Fitzroy, and vol. iii by Darwin. From 1843 to 1845 Fitzroy was governor of New Zealand, where his endeavors to conserve the rights of the Maoris against the European settlers made him unpopular. In 1854 he was appointed meteorologist to the Board of Trade. The 'Fitzroy barometer' was his invention; and he also instituted the system of modern storm warnings.

Fitzroya, a genus of small, evergreen, hardy, and half-hardy coniferous trees. *F. patagonica* and the smaller *F. Archeri* are the two principal species.

Fitzurse, Reginald (fl. 1170), one of the four knights who, hearing Henry II's angry outcries against Becket, accomplished the murder of that prelate. (See Becket.)

Fitzwilliam Museum, a museum at Cambridge, England, founded by Richard, Viscount Fitzwilliam, an Irish peer, who left his picture gallery, library, engravings, and £100,000, to the university. Additions from other collections have been made at intervals. The collection is specially rich in sculptures and antiques.

Fiume, fyo͞o'mĕ, city, seaport and naval station, Italy, in the province of del Carnaro (Fiume), situated at the head of the Gulf of Quaron an inlet on the eastern side of the Adriatic Sea; 35 miles southeast of Trieste. It consists of an old and a new town; the old containing the Cathedral of the Assumption (1377) and a Roman triumphal arch erected in the third century. Fiume's geographical position makes it an important commercial center for a considerable territory formerly included in Austria-Hungary, but after the World War belonging to Hungary and the new Jugoslav state. A free port from 1717 till 1891, it has a harbor with a lighthouse and several breakwaters, which have been greatly improved in recent years. Paper, torpedoes, tobacco, and chemicals are manufactured, and there are also rice mills and petroleum refineries. Fisheries are of importance. Pop. (1936) 53,896.

Fiume originally belonged to the Byzantine Empire. It was under the control of Austria from 1471 to 1822, when it was ceded to Hungary. In 1848 it was annexed to the crown lands of Cro-

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Fiume, Showing the Bridge which Separates the Slav and Italian Sections of the City.

atia, but passed back to Hungary in 1870. At the close of the World War the city was a bone of contention between Italy and the newly organized Jugoslav state. The latter claimed it as an economic necessity as her only means of access to the sea, while Italy insisted that the town was essentially Italian and that its possession was necessary to her safety in the face of a potential enemy. After prolonged discussion a settlement of the matter, whereby Fiume should be a free city, seemed imminent. On Sept. 12, 1919, however, Captain Gabriele d'Annunzio, the Italian poet and aviator, entered Fiume with armed forces and proclaimed its union with Italy. The occupation was denounced by the government and a blockade was declared against the city, but public opinion in D'Annunzio's favor was strong, and on Sept. 7, 1920, he proclaimed the independence of the town.

By the treaty of Rapallo, concluded in November, 1920, both Italy and Jugoslavia recognized the independence of Fiume. D'Annunzio, dissatisfied with the frontiers assigned by the treaty, refused to recognize its terms, but after some disorder was forced to leave the city.

The treaty, however, failed to give real satisfaction in any quarter. The aspirations of the Italians and of the Jugoslavs were alike unsatisfied, while the difficulties of maintaining a separate state made it unpopular with the Fiumians. One of the chief difficulties was in the disposal of Porto Barros, an important unit in the Fiume port system, which was said to have been promised to Jugoslavia by a secret clause in the treaty. Affairs were further complicated by the overthrow of the Fiume provisional government early in 1922 by the Fascisti. Italian troops were dispatched to the city to maintain order, and military rule was continued until the conclusion by Italy and Jugoslavia of the treaty of Santa Margharita on Jan. 27, 1924. The treaty provided for the annexation of Fiume and its harbor to Italy, while Porto Barros went to Jugoslavia, both ports to be administered jointly by the two countries. On March 16 the formal annexation of the city to Italy was proclaimed.

Five Forks, BATTLE OF, a battle fought on April 1, 1865, at Five Forks, Va., about 11 miles southwest of Petersburg, between a Federal force of about 25,000 under General Sheridan and an inferior Confederate force, belonging to Lee's army, under General Pickett. The battle was hotly contested, the Confederates fighting bravely against heavy odds, but being finally defeated and forced back to Sutherland Station. The Federal loss was less than 1,000; that of the Confederates probably about 8,000 (including about 5,000 prisoners). Strategically the battle was of great importance, since it settled the fate of Petersburg, which was evacuated by the Confederates on April 3 (Richmond being evacuated on the same day), and placed General Grant in possession of the Southside Railroad. Eight days after the battle Lee surrendered.

Five Hundred, COUNCIL OF. See COUNCIL OF FIVE HUNDRED.

Five Members, THE, were those members of the English parliament—John Pym, John Hampden, Denzil Holles, Sir Arthur Haselrig, and William Strode—whom Charles I. endeavored to arrest on January 4, 1642. This action, by which Charles had meant to prevent the impeachment of the queen, precipitated the Civil War. See CHARLES I.

Five Mile Act, THE, a statute passed by the English Parliament in the reign of Elizabeth (35 Eliz. c. 2), prohibited Roman Catholics convicted of not attending the established church from going more than five miles from their usual place of abode. Another act of the same name, passed in October, 1665, prohibited nonconformist preachers and teachers, who refused to take the oath of nonresistance, from coming within five miles of any city, town, or borough corporate, returning members to Parliament, or of any place where they had preached since the Act of Oblivion (1660). This act was repealed in 1689.

Five Nations. See IROQUOIS.

Fivizzano, fē-vit-sä'no, town, Italy, province of Massa and Carrara, on the Apuan Alps; 18 miles northeast of Spezia. It has quarries of Carrara marble. Pop. (1936) 17,818.

Fixed Bodies, a term applied in chemistry to those substances which remain fixed, and are not volatilized at moderately high temperatures.

Fixed Oils, those oils, which, on the application of heat, do not volatilize without decomposition. (See OILS.)

Fixed Stars, the stellar host distinguished by their apparent immobility from 'wandering stars' or planets. The epithet 'fixed' embodies, besides, the ancient conception of the stars as fastened (*infixæ*) like nails to the surface of the sky. The 'fixed stars' belonged to the eighth Ptolemaic sphere, and revolved with it once in twenty-four hours, impelled by the whirling ninth sphere, the *primum mobile*. In modern terminology the expression is little used.

Fixtures. Personal property affixed or annexed to real estate in such a manner and under such circumstances as legally to become a part of it. The substance of this definition is accepted by the general weight of authority, but some cases adhere to the opposite idea, holding that the term is properly applied to chattels affixed to real estate, which may lawfully be taken away by the tenant upon leaving or the owner upon sale. However, the first definition is logically the best, as this branch of the law deals with the exceptions to the general rule that whatever is attached to real estate becomes a part and parcel of it. It is practically impossible, under the authorities, to lay down exact rules by which to determine with certainty whether an article attached to the realty has become a fixture or not, and where there is no precedent in a particular case, the only sure way is to litigate the question.

In general, it may safely be said that a chattel will become a fixture after it has been attached to real estate, and become appurtenant to it to the extent of being necessary or especially adapted to the convenient use of the whole or any portion of it, and with the intention of having it remain there permanently.

Modern tendency is to give great weight to the intention and the circumstances under which the chattel is affixed. Intention may be inferred from the circumstances, as for example, enclosing a heavy stationary boiler in a permanent structure, a part of which would have to be destroyed in order to remove the boiler, would show an intention to make the latter a fixture. However, the intention does not govern to the exclusion of the principles of the general rule, if the chattel is so affixed that its removal would cause material injury, or what is technically known as waste, to the real estate. This subject is of great importance to tenants of land, and on the whole the law favors a tenant as against the landlord, the doctrine of 'trade fixtures' having grown up to protect the former. Under this rule of exceptions, chattels affixed to the land by the tenant, which are especially adapted for the purpose of carrying on his trade or occupation may be removed before or at the end of his term. In some states he has a reasonable time after the expiration of his term to do this, unless he indicates an intention to abandon them, and it is never safe to allow the term to expire without removal, except where there is an express agreement between the parties.

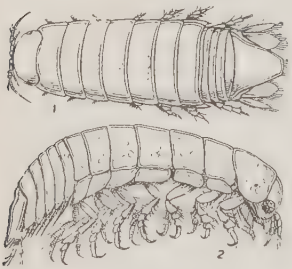
In the United States, barns, granaries, etc., erected by an agricultural tenant for his own use, have been held to come under the rule of exception. Exceptions have also been made in favor of particular articles, the character of which would be hard to determine in absence of precedents. For example, *gas fixtures* may be removed by a tenant who has affixed them, or an owner who has sold his house. The law favors grantees and mortgagees as against grantors and mortgagors in doubtful cases, and heirs as against executors.

The precedents in the jurisdiction in which a case arises must be examined, as opposite decisions in regard to certain chattels obtain in different jurisdictions. For example, the cars and locomotives of a railroad company are fixtures in some States, and movable chattels in others.

See LANDLORD AND TENANT; PERSONAL PROPERTY; REAL PROPERTY. Consult Ewell's *Treatise on the Law of Fixtures* (new ed. 1905).

Fjord, fyord. See FIORD.

Flabellifera, flā-bel-if'*er-a* ('fan bearer'), a name applied to a tribe of isopods, in which the body ends in a tail fan, made by the last pair of appendages and the telson (end piece). A large number of families are included in the tribe, whose members, in some instances, are parasitic upon fish, and share with certain parasitic copepods the title of *fish lice*. Examples of these parasitic forms are the species of *Conilera* and *Cirolana*. Of the non-parasitic forms, *Limnoria lignorum* (q. v.), or the 'gribble,' has a destructive action on submerged wood.



Flabellifera.
1. Cirolana microphthalmia. 2. Limnoria lignorum.

Flabel'lum (Latin, 'a fan'). (**1.**) The fan used in the ecclesiastical service of the Roman Catholic and Greek Churches. (**2.**) A genus of solitary corals of the order Madreporaria, some of whose species show well-marked alternation of generations. (**3.**) The name of certain appendages in some Arthropods.

Flaccus, flak'us, the family name of three distinguished Romans:

(**1.**) MARCUS FULVIUS FLACCUS was consul in 125 B.C. He was a friend of the Gracchi, and had previously been one of the triumvirs for executing the agrarian law of Tiberius Gracchus. He was murdered along with Gaius Gracchus in 121 B.C.

(**2.**) LUCIUS VALERIUS FLACCUS was consul along with Marius in 100 B.C., and assisted in suppressing the revolution of Saturninus. Later on in the civil war he was an associate of Marius and Cinna, and succeeded the former as consul in 86, in which year he was sent to wage war against Mithridates, but was murdered by his own troops.

(**3.**) CAIUS VALERIUS FLACCUS, a Roman poet who flourished about 80 A.D., and dedicated his work to Vespasian. This work is an epic poem in eight books, called the *Argonautica;* it is unfinished. He imitates closely the *Argonautica* of Apollonius Rhodius, and is a poet of little genius or originality, though his style and language are fairly polished.

Flach, flâsh, JACQUES GEOFROI (1846–1919), French historian, was born in Strassburg, and educated at the university there. In 1877 he became professor of law at the Ecole des Sciences Politiques, and in 1884 professor at the Collège de France. In 1912 he was elected to the French Academy. His works include: *Histoire du Régime Agraire de l'Irelande* (1883); *Jonathan Swift* (1886); *Etudes Critiques sur l'Histoire du Droit Romain du Moyen Age* (1889); *L'Origine de l'Habitation et des Lieux Habités en France* (1889); *Les Origines de l'Ancienne France* (3 vols., 1886–1904).

Flacius, flā'shi-us, MATTHIAS (1520–75), whose proper name was VLACICH, and who was surnamed ILLYRICUS, a theologian, was born at Albona in Illyria. In 1544 he became a professor at Wittenberg, where he came under the influence of Luther; and in 1557 he was appointed to the chair of theology at Jena, which he was forced in 1562 to resign. He then lived successively at Ratisbon, Antwerp, Strassburg, and Frankfort - on - the - Main. Founder of the science of hermeneutics, he was also a critic of church history. He opposed the Augsburg and Leipzig interims; he differed from most of his friends on the matter of original sin; he wrote numerous works—*e.g.*, the *Clavis Scripturæ Sacræ* (1567) and the *Catalogus Testium Veritatis* (1556).

Flag, a design, usually in colors, symbolizing authority or ownership, made of flexible material, as cloth, so as to wave in the air, and generally attached to a pole that is fixed, or to a staff that may be carried. Its origin goes back to remote antiquity, and may be traced to the whip and its lash, symbolizing the authority of a leader over men; hence its use in war. As a military ensign the flag was probably developed out of the fixed standard of the Romans and other ancient nations, through the transitional forms of the *vexillum* and *labarum*, in both of which a square piece of cloth was fastened to a cross bar at the end of a spear.

One of the earliest known forms was the *gonfanon* or *gonfalon* (q. v.), which was carried by the magistrates of mediæval Italian cities, and by those taking up arms in behalf of the Church. It was borne on the end of a staff, and fixed in a frame in which it could turn. Other older forms of flag are the following:

The *pennon* was an ensign of knightly rank, of a tapering, sometimes swallow-tailed shape, exhibiting in earlier ages some decorative design, and, after the introduction of heraldry, sometimes the badge, sometimes the arms of its owner. A diminutive flag of a similar kind, called the *pennoncel*, was carried by the esquires.

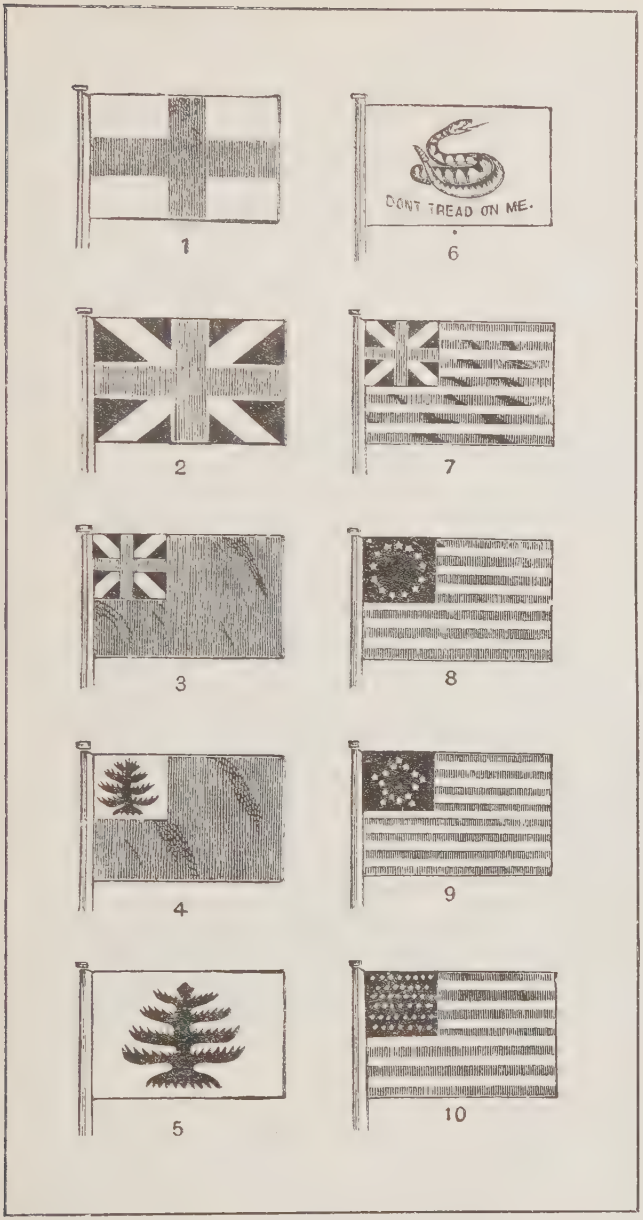
The *banner*, rectangular in form, was borne by a king, prince, duke, or any other noble down to a knight-banneret (see BANNERET). The owner's coat of arms covered its entire surface, no shield or external ornaments being displayed.

The *standard*, deeper and longer than the banner, varied in size according to the rank of the individual, and displayed not his arms, but his badge or badges. (See STANDARDS.)

United States.— Prior to the War of the Revolution the flag generally used in the American colonies was, of course, that of Great Britain, though at different times, in different colonies, minor variations were introduced, and distinctive emblems were occasionally used. In 1686 the United Colonies of New England, under Governor Andros, began using a white flag bearing the cross of St. George, emblazoned in the centre, with a yellow or gilt crown over the letters 'J. R.' (*Jacobus, Rex*, 'James, King'). This flag seems to have gone out of use in 1707, when Great Britain adopted for the whole realm the Union flag of King James.

During the early part of the Revolutionary period each colony used an emblem of its own—frequently the colonial coat of arms, with the addition of some motto, as *'Qui Transtulit Sustinet,'* 'George Rex and the Lib-

Flag



American Flags, Colonial and National.

1. Red Cross flag of Great Britain, Ensign of Henry VII., planted on North American soil by Sebastian Cabot in 1497. 2. Flag of Great Britain, and of the Colonies from 1620 to June 14, 1777, showing the red cross of St. George and the white cross of St. Andrew on a blue field. 3. Flag formed by changing the color of the British flag to crimson and placing the two crosses in the upper corner, adopted in 1707. 4. Colonial modification of flag of 1707, one of the flags of Massachusetts colony. 5. Pine Tree Flag, also of Massachusetts colony, adopted for American vessels in 1775. 6. Flag of the southern colonies, 1776-7. 7. First striped flag, known as the 'Cambridge Flag' and in Great Britain as the 'Rebellious Stripes,' raised at Washington's headquarters, Cambridge, Jan. 2, 1776. 8. First flag of thirteen stars and stripes, adopted by the Continental Congress, June 14, 1777. 9. Flag as changed in 1794 by addition of two stripes and two stars for Vermont and Kentucky—flag of the War of 1812. 10. Flag authorized by Act of Congress, April 4, 1818, with thirteen stripes and one star for each State.

erties of America, or 'No Popery.' Both at that time and earlier the rattlesnake was a favorite device; and after the outbreak of hostilities, banners appeared bearing representations of rattlesnakes with thirteen rattles, symbolic of the thirteen colonies, and having such mottoes as 'Unite or Die' (1775) and 'Don't Tread on Me' (1776). On Jan. 2, 1776, a new flag was raised at Cambridge, where the American army was then assembled. This flag retained the Union Jack to indicate that the colonists still recognized their allegiance to Great Britain, and in addition had, as a field, thirteen stripes, alternate red and white, to represent the thirteen colonies.

Finally on June 14, 1777, the Continental Congress adopted a flag, having, as before, a field of thirteen stripes, but substituting for the Union Jack a union of thirteen stars on a blue ground, 'representing a new constellation.' The anniversary of this day is celebrated in all the States of the Union as *Flag Day*. According to tradition, the first flag after the new design was made by Betsey Ross in Philadelphia. There is some uncertainty both as regards the origin and the first use by the army and navy of this new flag—probably, however, it was first used at Fort Stanwix on Aug. 6, 1777.

No change was made in the national flag until January, 1794, when two new States, Vermont and Kentucky, having been admitted to the Union (in 1791 and 1792 respectively), Congress increased the number of both stars and stripes by two. The next change was made in 1818, when five new States (Tennessee, Ohio, Louisiana, Indiana, and Mississippi) having been admitted, Congress restored the thirteen original horizontal stripes, increased the number of stars to twenty, and provided that on the admission of every new State one star be added to the union of the flag, the addition taking effect on the Fourth of July succeeding such admission. This law still remains in force—the last two stars, added in 1912 for Arizona and New Mexico, bringing the present number to forty-eight. The manner in which the stars were to be arranged in the union of the flag was not prescribed, and for a long time considerable diversity existed in this respect. On Oct. 29, 1912, however, the proportions were definitely fixed, and the numbers and sizes were defined by executive order.

Confederate States.—The Confederacy in 1861 adopted what is known as the 'Stars and Bars'—three horizontal bars, two red and one white, and seven stars

(later increased to thirteen) in a blue field. The Confederate battle flag, however, consisted of a red field bearing a Greek cross (blue bordered with white), with thirteen white stars. In 1863 a national Confederate flag was adopted, consisting of the battle flag used as a union on a white field. Two years later the width of the flag was increased by a red bar across the end of the field.

Army.—In the U. S. Army the flags range from the large national ensign flown at the post or garrison flagstaff to the silk colors and guidons carried by the troops (see COLORS, MILITARY). The design and construction of these are prescribed by *Army Regulations*, as also are those of the President, the Secretary of War, and the Assistant Secretary. The *President's flag* is blue, with the official coat of arms of the United States; that of the Secretary of War is similar, but has a scarlet field; the Assistant Secretary of War's flag has a white field. For the various military salutes, see SALUTES.

Navy.—In the U. S. Navy the national flag, called the *ensign* or the *colors*, is carried at the spanker (or main, if there is no mizzen mast) gaff, or on a flagstaff at the stern. In addition to the national ensigns, a man-of-war has on board several union jacks, the man-of-war flag of every maritime nation, and a large number of distinguishing and signal flags. The union jack —or the 'jack,' as it is commonly called—is simply the blue field and stars of the national ensign. In fine weather, when a vessel is at anchor, the jack is hoisted on the jackstaff at the stem of the ship. The flags of foreign nations are used for purposes of ceremony connected with salutes or courtesies to foreign nations or dignitaries (see SALUTES). The personal distinguishing flags are used to indicate the presence on board of an official of rank. The Secretary of the Navy has a blue flag with four white stars and a white anchor, which in the case of the Assistant Secretary is reversed to give a blue anchor and stars in a white field. A squadron commander and a division commander also fly special flags. A white triangular pennant with a blue Latin cross is the navy call to church. A white or yellow flag indicates the presence of a contagious disease or quarantine. The white flag with the red cross of the Geneva Convention is flown over hospitals, ambulances, hospital ships, and other places made neutral by the terms of that Convention. For the use of signal flags, see SIGNALLING.

Other Flags.—There are numerous flags, in addition to those of Army and Navy officials, that are used to designate official position or authority. The latest of the departmental flags are those of the Department of Commerce. That of the Secretary is a full-rigged ship in blue over a lighthouse in blue in a white shield on a blue ground, with a five-pointed white star in each corner. The flag of the Assistant Secretary is similar, with the colors reversed. In this department there are also four service flags, as follows: Bureau of Navigation, a full rigged ship, white, in a red circle on a blue field; Coast and Geodetic Survey, a red triangle, base down, in a white circle on a blue field; Bureau of Fisheries, blue field with a white fish on a red diamond in the centre; Bureau of Lighthouses, triangular in shape, white field with a red border, bearing a blue lighthouse. The chief of each of these bureaus has an individual flag, consisting of a blue field with the special design of the office in white in the centre.

A special flag for the Governor of the *Panama Canal*, authorized in 1915, consists of a dark blue field, in the centre of which, in a white circle, is the seal of the Canal Zone. The seal consists of a shield, showing in base a Spanish galleon of the fifteenth century under full sail coming head on between two high banks, all purpure, the sky yellow with the glow of sunset; in the chief are the colors of the arms of the United States. Under the shield is the motto: 'The Land Divided; the World United.'

Great Britain. — The national flag of Great Britain is the Union Jack—more properly called the 'Great Union'—established by royal proclamation of April 12, 1606. It was formed by a combination of the crosses of St. George and St. Andrew; and at the union with Ireland, in 1801, the cross of St. Patrick was added. The Union flag, pure and simple, is essentially the military flag of England. It is also used as a ship-of-war's jack, and as such is flown on the jackstaff forward; as a flag of command in the navy it is the flag of an admiral of the fleet, who flies it at the main truck. The chief naval and maritime flags in which it finds place are called *ensigns* (see ENSIGN), and are flown at the mizzen peak, or on the ensign staff of every vessel. The White Ensign is the peculiar flag of the royal navy; the Blue Ensign is the distinctive ensign of the Royal Naval Reserve; and the Red Ensign is the flag of the British merchant service.

The primitive British flag, that of St. George — a white field with a red upright cross on it— survives only as a flag of command in the royal navy. It is flown at the main truck by an admiral; a vice-admiral flies a similar flag with one red ball in the upper canton next the staff; and a rear-admiral a similar flag with a red ball in each of the two cantons next the staff.

British Colonies.—The colonial flags of Great Britain are many, and frequently consist of the British flag along with some pertinent design symbolical of the colony displayed in the field. William III., in 1701, directed that a white escutcheon should be placed in the centre of the Union in any flag hoisted by a colonial vessel. The white escutcheon is now decorated with the arms of *Canada* for the Canadians, with the southern cross for *Victoria*, with the red cross and British lion for *New South Wales*, with the black swan for *West Australia*. In 1865, when colonial navies were instituted, the warships maintained by the local governments were granted the Blue Ensign, and the distinctive colonial badge was placed in the centre of the fly. At the same time colonial warships were allowed to hoist as a command pennant one similar to that used by British ships, but with a blue fly—*i.e.*, a St. George's cross on a white ground next the staff, and a blue streamer.

The *Merchant Flag* of *Canada* bears the Canadian coat of arms in appropriate colors on the right side of the red field of the British merchant flag; that of *Australia* consists of six stars of unequal size distributed irregularly on the red field, significant of the six original states of the Commonwealth; and the flag of *New Zealand* shows four five-pointed stars on the blue field of the British ensign.

Germany.—Prior to the founding of the Third Reich in 1933, the German naval flag consisted of a white field bearing a black, white-edged cross, in the center of which was a white circle containing the Prussian black eagle. In the upper canton next the staff were three bars—black, white, and red—surmounted by the black iron cross. The black, white, and red flag, minus the cross, was the emblem of the German merchant marine. Under the Nazi decree of March 12, 1933, the new flag of red, with a black swastika mounted on a white circle in its center, was to be flown thereafter with the black, white, and red flag of the empire.

France.—The French flag is the 'Tricolor'—blue, white, and red in vertical bars, the blue being next the staff. It came into existence in 1789. A special flag for the

Flag

President of the French Republic consists of the tricolor, with the letters 'R. F.' displayed on the white bar. The flag of the French mercantile marine is the same as the navy. The admiral's flag in the French navy is a swallow-tailed tricolor. A vice-admiral and a rear-admiral hoist the rectangular tricolor — the former with three white stars on the blue, the latter with two.

Russia.—Under Czarist Russia, the highest form of Russian naval flag was the blue diagonal cross of St. Andrew on a white ground. The flag of the merchant marine, and of warships not belonging to the Imperial

Spain.—The national flag of Spain is composed of three equal horizontal bars of red, yellow, and blue, with the Spanish coat of arms emblazoned in its center. Without the central insignia, the banner becomes the official emblem of the Spanish merchant marine.

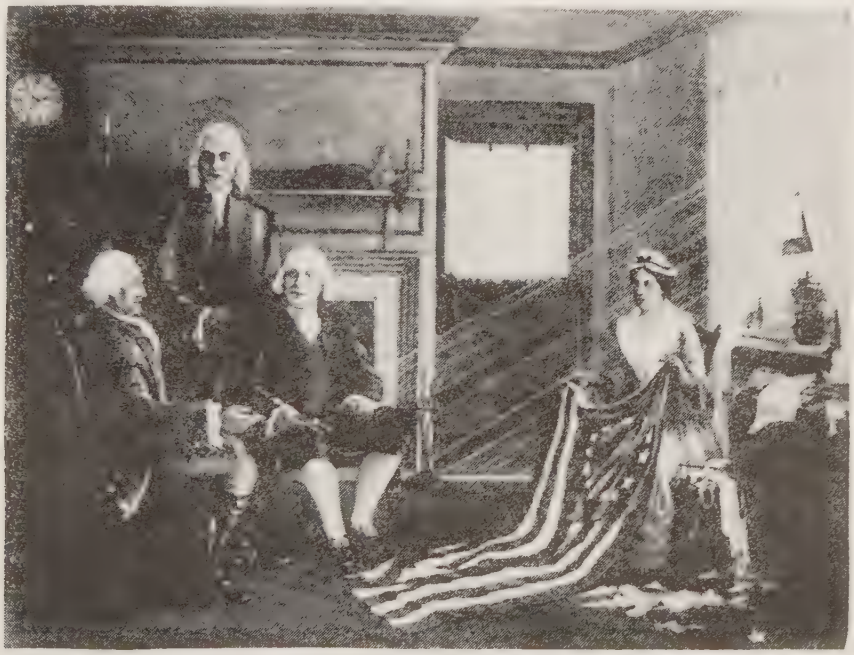
Portugal. — The Portuguese flag consists of two vertical stripes of green and red, the green nearer the staff and a third narrower than the red. The naval flag, in addition, bears in the centre of the field, at the junction of the colors, a navigator's sphere on which is the national coat of arms — a white shield

and the merchant flag are striped horizontally, red, white, and blue.

Belgium.—The Belgian flag is striped vertically, black, yellow, and red.

Greece.—The flag of the Greek navy has nine horizontal stripes, alternately blue and white, the upper quarter next the staff being blue, with a white cross, in whose centre is a crown. The merchant flag is without the crown.

Turkey. — The naval flag is red, charged with a decrescent moon and an eight-pointed star, both white. The merchant flag is green, with a red circle in the centre, on which is a white decrescent moon.



Courtesy Chicago Historical Society

BIRTH OF THE AMERICAN FLAG

Guard, was white, blue, and red, in three equal horizontal bars. Following the formation of the Soviet Union in 1924, the Communist government adopted a red flag with the party emblem (the crossed sickle and hammer, surmounted by a star) in yellow in the upper left corner of the banner.

Hungary.—The national flag of Hungary consists of three equal horizontal bars of red, white, and green, with or without the coat of arms in the center.

Italy.—The naval flag of Italy is of green, white, and red in vertical bars, bearing the arms of Savoy in the centre, with a royal crown above. The flag for the mercantile marine bears no crown above the shield, but is otherwise the same as the naval flag.

within a red shield, on the latter seven golden castles, on the former five smaller blue shields.

Norway and Sweden. — The Norwegian flag is red, with a blue cross bordered with white; the Swedish flag is blue, with a yellow cross. The blend for the union was arrived at by quartering each flag diagonally, and placing the Swedish sections horizontally and the Norwegian sections vertically, with the points of each converging in the centre. For men-of-war both flags are swallow tailed, with the arm of the cross projecting between the tails, and pointed.

Denmark.—The Danish flag is red with a white cross. The naval flag is swallow tailed, the merchant flag rectangular.

Netherlands.—Both the naval

Japan.—The naval flag represents the rising sun—a red central disc, with alternate red and white spreading rays. The flag of the mercantile marine is white with a simple red disc in the centre.

China.—When imperial China gave way to a republican form of government, the familiar flag—an ancient dragon on a yellow field—was abolished, and a national ensign adopted, consisting of five equal horizontal stripes of colors, arranged according to the importance of the races which they represent, as follows: At the top, red, for the Chinese race; next, yellow, for the Manchurian; blue, for the Mongolian; white, for the Mohammedan; and black, for the Tibetan.

Mexico.—The Mexican flag is

a tricolor of green, white, and red, bearing the Mexican arms on the white stripe when flown as a naval ensign, and plain when flown on merchant vessels.

Republic of Panama.—This flag consists of four equal squares, the upper one, nearest the staff, being of white with a blue star in the centre, while beneath is a square of solid blue. On the outer edge the upper square is of solid red, and beneath is a red star on a white ground.

South American Republics.—The majority of the flags of the South American republics are simple tricolors for the merchant marine, and tricolors displaying the national arms for the navy. The naval flag of the *Argentine Republic* is horizontally striped blue, white, and blue, bearing an emblazoned sun on the white stripe. The same flag without the sun is used by the merchant marine. The flag of *Brazil* is green, with a central disc of blue on a yellow diamond. The disc shows eighteen stars in white, and the motto *Ordem e Progress*. The flag of *Chile* consists of two horizontal bars, the lower one red, the outer two-thirds of the upper one white, the third next the staff blue, with a single white star. The flag of *Peru* is red, white, and red, in vertical stripes, with the national arms on the central stripe for the naval flag, and plain for merchant vessels.

Miscellaneous.—The use of flags as distinctive emblems is on the increase. Nearly every State of the United States has now its special flag, and many of the cities have theirs—*e.g.*, that of *Baltimore*, adopted in 1914, and that of *New York City*, adopted in 1915. Colleges display their colors in the form of a flag, usually charged with some symbolic design, as the college seal; and the various college fraternities and patriotic organizations have also their special flags.

There are various peace flags, one of which, known as the *Rainbow Flag*, consists of a white field with a rainbow in colors, arched between the lower corners; while another consists of the national emblem of any country surrounded by a border of white. Two flags have been used extensively in the Sunday School movement—the *Conquest Flag*, bearing a red cross on a white ground, with the words, 'In This Sign We Conquer'; and the *Christian Flag*, showing a white ground, with a blue field in the upper corner, and a cross of red.

After the entrance of the United States into the Great War in 1917, a *Service Flag*, oblong in shape, with red border, white field, and a blue star for each person serving with the colors, was widely displayed by homes, business houses, etc., a gold star being added in honor of men dying, and a silver for men wounded, in the service. While not officially adopted, this flag received the recognition and sanction of the U. S. Government.

Displaying the Flag.—There is no Federal law in force pertaining to the manner of displaying or saluting the United States flag, except that providing that no trademark can be registered which consists of, or comprises, *inter alia*, the flag or any simulation thereof.

It is the practice in the Army, each day in the year, to hoist the flag briskly at sunrise, irrespective of the condition of the weather, and to lower it slowly and ceremoniously at sunset, and to display it at half staff on Memorial Day (May 30) from sunrise until noon and at full staff from noon until sunset, the flag always being hoisted to the top of the staff before being lowered to the half staff position. The Army Regulations provide also that when officers and enlisted men in civilian dress pass the national flag, not encased, they will uncover, holding the headdress opposite the left shoulder with the right hand; if uncovered they will salute with the right hand salute.

The following suggestions as to displaying the flag are offered by the Adjutant General's Office: that as far as possible the hanging of the flag should be restricted to suspending it from a flag pole, in the regular way; that if it is the desire to use the flag for decorative purposes it should always be hung flat with the union to the north or east; that it should rarely be displayed in a horizontal position or laid flat; that under no circumstances should it be hung where it can easily be contaminated or soiled; that no object or emblem of any kind should be placed above or upon it.

The Adjutant-General's Office also advises that old or worn out flags should not be used either for banners or for any secondary purpose, but should be destroyed as a whole, privately, preferably by burning or by some other method lacking in any suggestion of irreverence or disrespect.

Many of the States have laws affecting the use and respect to be paid the flag within their own jurisdiction.

See STANDARDS. Consult Hulme's *Flags of the World;* Preble's *The American Flag;* Gordon's *Flags of the World, Past and Present* (1915); Stewart's *The Stars and Stripes, A History of the United States Flag* (1915).

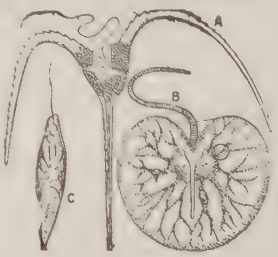
Flag, a popular name for many monocotyledonous plants with sword-shaped leaves, mostly growing in moist situations. It is sometimes particularly appropriated to certain species of iris, especially to the common *Yellow Flag* (*I. pseudacorus*) and *Blue Flag* (*I. versicolor*). (See IRIS.) It is also given to other plants of similar foliage, as the *Acorus calamus*, which is called *Sweet Flag*. See ACORUS.

Flag Day. See FLAG, *United States*.

Flagellants, flaj'e-lants, THE (Latin *flagellare*, 'to scourge'), a name applied to certain religious fraternities practising self-flagellation. The first of these originated at Perugia in 1260, at a time when society in Italy was greatly disorganized by the long-continued struggles of the Guelf and Ghibelline factions. Later offshoots made their appearance in Bavaria, Austria, Moravia, Bohemia, Poland, and France. In the second outbreak of Flagellantism, about 1349, men and women indiscriminately appeared in public half naked, and ostentatiously underwent these self-inflicted scourgings. The immediate occasion of this outburst was the plague known as the Black Death. In 1414 a new troop of Flagellants, locally called *Flegler*, made their appearance in Thuringia and Lower Saxony. Their violence drew upon them the severest punishments of the Inquisition, and Conrad Schmidt, their leader, was burned at Sangerhausen in 1414.

The Flagellants protested against clerical domination, and repudiated many of the dogmas of the Church. Their doctrines were condemned by the Council of Constance (1415). Consult W. M. Cooper's *Flagellation and the Flagellants*.

Flagellata, flaj-e-lā'*ta*, or FLAGELLIDIA, an order of Protozoa characterized by the presence of



Flagellata.
A. Ceratium tripos; B. Noctiluca; C. Euglena.

flagellæ, or whip-like structures, which by their movements propel the organisms through the water (see FLAGELLUM). In many of the flagellate forms chlorophyll is present, and these forms have been regarded by botanists as minute Algæ. Examples of flagellates are the colonial *volvox*, which contains chlorophyll; *Cera-*

tium tripos, very common at the surface of the sea; the phosphorescent *Noctiluca;* and the fresh-water *Euglena*.

Flagellation, flaj-e-lā'shun, a form of ecclesiastical punishment, in use in religious communities since the fifth century. The Roman Catholic Church sanctions this form of chastisement, under certain conditions, as an aid to self-discipline and piety.

Flagellum, fla-jel'um, a vibratile filament of living matter associated with a cell, whether that be an isolated unit as in most flagellate Infusorians, or an element in a multicellular organism, as in the flagellate chambers of a sponge. A flagellate cell has in most cases a single flagellum, and two are not uncommon. See FLAGELLATA; CILIATA.

Flageolet, flaj'ō-let, a wind musical instrument made of wood. It is a form of the ancient *flûte à bec*, or straight whistle, and in method of tone production and construction greatly resembles the ordinary tin whistle. It is said to have been invented by the Sieur Juvigny about 1580. The English flageolet has the same scale as the flute. The French flageolet is a smaller variety, having only four holes in front, with two behind for the thumbs, and additional keys.

Flagg, ERNEST (1857), American architect, was born in Brooklyn, N. Y. He studied under Blondel at the Ecole des Beaux-Arts, Paris (1889–91). He was the architect of St. Luke's Hospital and the Singer Building, New York City; the Corcoran Gallery of Art, Washington, D.C.; and the United States Naval Academy at Annapolis. His publications include articles on roads and pavements, model tenements, and kindred subjects.

Flagg, GEORGE WHITING (1816–97), American painter, was born in New Haven, Conn., and studied art under his uncle, Washington Allston, and in Europe. He resided in London for three years, but eventually settled in New York City. His works are chiefly historical and genre pieces, among which may be mentioned: *Murder of the Princes; Landing of the Atlantic Cable; Washington Receiving His Mother's Blessing; The Good Samaritan; Columbus and the Egg; The Match Girl; Haidee.* He was a member of the National Academy of Design.

Flagg, ISAAC (1843), American classical scholar and author, son of Wilson Flagg (q. v.), was born in Beverly, Mass. He was prepared for college at Phillips Andover Academy, graduated from Harvard University (1864), where he became a tutor (1865–9), and studied at the Universities of Berlin and Göttingen (PH.D.) (1869–71). He was professor of Greek at Cornell (1871–88); and associate professor of classical philology (1891–1909), and professor of Greek, emeritus (after 1909) at the University of California. His published works include *Pedantic Versicles* (1883); *Outlines of the Temporal and Modal Principles of Attic Prose* (1893); *Hylèthen, a Lyrical Missive* (1896); *A Writer of Attic Prose* (1902); *Circe, a Dramatic Fantasy* (1915); *Persephone, a Masque* (1916). He edited Demosthenes' *Hellenic Orations;* Æschylus' *Seven Against Thebes;* Euripides' *Iphigenia in Tauris; Lives of Cornelius Nepos;* the *Apology* and *Crito of Plato.*

Flagg, JAMES MONTGOMERY (1877), American author and artist, was born in Pelham Manor, N. Y. He studied at the Art Students' League, at the Herkomer Art School, Bushey, England, and in Paris under Victor Marec. His work includes portraits in water color and oil, and a great number of illustrations in pen and ink, crayon, and charcoal. He was appointed official military artist of New York State upon America's entrance into the Great War and has executed numerous striking war posters. He wrote and illustrated *Tomfoolery* (1904); *If: A Guide to Bad Manners* (1905); *Why They Married* (1906); *All in the Same Boat* (1908); *City People* (1909); *The Adventures of Kitty Cobb* (1912); *I Should Say So* (1914); *The Well Knowns* (1914); *The Mystery of the Hated Man* (1916); and is the author of various moving picture scenarios.

Flagg, JARED BRADLEY (1820–99), American painter, was born in New Haven, Conn., and studied art with his brother, George W. Flagg (q. v.), and with his uncle, Washington Allston. He specialized in portrait painting, and was elected a member of the National Academy in 1850. Subsequently he studied theology, and entered the ministry of the Protestant Episcopal Church (1854), in which he labored for ten years, and then returned to his painting. Among his best-known portraits are those of William M. Evarts and Chief Justice Church, in the Capitol at Albany, and of Commodore Vanderbilt and John Jay. He prepared *The Life and Letters of Washington Allston* (1892).

Flagg, WILSON (1805–84), American naturalist, was born in Beverly, Mass., and was educated at Phillips Andover Academy. He spent much of his early life in travelling about the country on foot. Subsequently he delivered lectures on natural science, and became a writer on political subjects for the Boston *Weekly Magazine* and the Boston *Post*. He later abandoned political discussion, and devoted his energies to agricultural topics. Among his works are: *Studies in the Field and Forest* (1857); *Woods and Byways of New England* (1857; reprinted as *A Year Among the Trees*, 1881); *Birds and Seasons of New England* (1875; reprinted as *A Year with the Birds*, 1889).

Flagler, flag'ler, HENRY MORRISON (1830–1913), American capitalist, was born in Canandaigua, N. Y. He did much for the development of the resources of Florida, where he founded towns, brought large areas under cultivation, and built the great Ponce de Leon and Alcazar hotels (costing $3,000,000) at St. Augustine. He improved the steamboat and railroad facilities of the State, constructing an extension of the Florida East Coast Railway from Miami to Key West across the intervening keys (opened 1912), which provided uninterrupted travel between New York and Key West, and greatly shortened the time to Havana.

Flagler, ISAAC VAN VLECK (1848–1909), American organist and composer, was born in Albany, N. Y., and studied under H. W. A. Beale at Albany, and under Batiste and other masters at Paris. He was organist of churches at Poughkeepsie and Albany, N. Y., of Plymouth Church, Chicago, and of the First Presbyterian Church, Auburn, N. Y. He was for many years organist and musical lecturer at Chautauqua, and at various times gave musical instruction at Syracuse and Cornell Universities. He published: *Three New Collections of Organ Music; Organists' Treasury; Collection of Choir Music; New Era of Song; Songs of Praise and Devotion.* His *Variations on an American Air* is well known.

Flag Officer, a naval officer of the line or executive branch, whose rank entitles him when at sea to fly a flag or broad pennant, instead of the narrow pennant of a captain or junior commanding officer. In the United States and British Navies, the flag officers are *admiral, vice-admiral,* and *rear-admiral.* See ADMIRAL.

Flag of Truce, a white flag displayed by opposing war forces to indicate that a conference is desired. It is despatched from one commanding officer to the other, and its bearers are ordinarily safe from detention or attack, unless they are suspected of being spies.

In naval warfare a vessel carrying the white flag may approach only within such limits as will cause her mission to be recognized. If the enemy refuses to communicate, the vessel must retire; if a conference is granted the party is met by an officer of proper rank whose boat also bears a white flag. See TRUCE; CAPITULATION.

Flagship, the ship in a fleet which bears the admiral's flag, forming a sort of centre to which all other vessels look for orders. It is usually the most powerful vessel in the fleet.

Flag Signalling. See SIGNALLING; SEMAPHORE.

Flagstad, KIRSTEN (1895–), opera singer and radio artist, was born at Hamar, Norway. When eighteen she made her debut as a soprano in the role of Nuri in D'Albert's *Tiefland* in Oslo. For twenty years she had an uneventful operatic career in Norway. In February, 1935, she made her debut as Sieglinde in the opera *Die Walküre* at the Metropolitan Opera House, New York, exciting critics with the range and clearness of her soprano voice. Singing mainly Wagnerian roles she has appeared in the principal cities of America, Australia and Europe.

Black Star Photo by Schneider

KIRSTEN FLAGSTAD

Flagstaff, Arizona, county seat of Coconino County, on the Santa Fe Railroad northeast of Prescott. Situated in the mountains it is a resort for consumptives and is the center of a large lumbering and stock-raising district. Lowell Observatory and Arizona State Teachers' College are located here. Pop. (1930) 3,891.

Flag'stone, a rock which splits into thin, flat slabs or flags in the original planes of stratification. Flagstones are generally sandstones combined with argillaceous or calcareous matter; some, however, are indurated clays, and others thin-bedded limestones.

Flamboyant, flam-boi'ant, a period in French Gothic architecture; also termed Third Pointed. Examples occur early in the fifteenth century, and continue until the middle of the sixteenth, when exuberant richness in decoration was the fashion. Flamboyant architecture is co-existent with the latter part of Decorated English architecture, and the whole period of the Elizabethan or Tudor style. It expressed itself in sculpture, color, tracery, and design; much of the later work being brilliant and rich, although less dignified than previous or contemporary styles. The name is derived from the flamelike waved lines in which the tracery of the heads of windows, panels, etc., was designed. The characteristics of this style are minute and elaborate ornament, combined with general bareness of surface. There are many large buildings in France executed in this style; and some of the spires of this period are very beautiful—*e.g.*, the northwestern spire of Chartres Cathedral.

Flame. When heat is evolved in chemical combination at a sufficient rate, the uniting bodies and their products may be made hot enough to shine. In most cases when this happens, the temperature reached is sufficient to vaporize the united bodies, and the gases produced, or already present, diffuse into each other, so that the union takes place over a considerable area. This area of heated gases is called a flame.

Structure of Flames. — As flames are generally produced by the union of one gas with another that surrounds it, they, as a rule, take the shape of hollow cones, the interior being filled with one unburnt gas and the exterior surrounded by the other. If simple gases like oxygen and hydrogen are uniting, the flame cone is simple and uniform; but with compound gases, as in the common cases of the flames of the hydrocarbon gases of coal gas, oil, or candles burning in air, the flame is more complicated, and can be distinguished as consisting of at least two parts. Thus, in a candle flame the dark unburned hydrocarbons of the vaporized candle are surrounded by a luminous part, in which there is insufficient oxygen to completely burn the gas; and this, in its turn, is enclosed in a faintly luminous mantle where there is excess of oxygen and the burning is completed. At the base of the flame is a small bright blue portion. That is the rudiment of an inner cone of combustion; and in a gas flame to which air has been admitted internally it becomes complete, and is separable by suitable means to a considerable distance from the outer cone.

Flames differ very much in appearance, according to the gases uniting. Thus, hydrogen burning in air is almost colorless and non-luminous; carbon monoxide burns with a blue, and cyanogen with a pink flame, both giving but little light; while hydrocarbons, phosphine, etc., burn with more or less luminosity.

Luminosity of Flames. — Flames give light for several reasons, one of the simplest being the presence in the flame of incandescent solid matter. Thus, in the incandescent gas lamp and in the limelight, solids are purposely put into an otherwise non-luminous flame; while in candle, illuminating gas, and oil flames, solid particles of carbon are the chief cause of the luminosity, being set free by the decomposition of the hydrocarbons present.

Solid particles are not the only cause of luminosity, as many highly luminous flames are known (*e.g.*, those of oxygen and hydro-

gen burning under pressure, carbon disulphide in nitric oxide, etc.) from which solids must be absent. In these cases high temperature and considerable density of the flame gases, which may be produced by pressure, increase or cause luminosity. The improved light given by coal gas when burned in the regenerative burner is due to the first factor; while the second makes the flame of hydrogen and oxygen luminous, though raising its temperature is ineffectual. The converse is also true: cooling and lowering the pressure on a flame are marked by a reduction in its light-giving power. Thus, in the Bunsen burner, although the addition of air to the inside as well as the outside of the flame makes combustion more complete, the admixture of the oxygen and nitrogen reduces the partial pressure of the coal gas, and thus causes a reduction of luminosity. In fact, a gas flame can be made non-luminous by admitting nitrogen or carbon dioxide to the interior of the flame instead of air, these gases being inert as regards combustion; but they lower the pressure of the gas and cool the flame.

Flame Flower, popular name given to various plants belonging to the genus Kniphofia or Tritoma (Liliaceæ). These are hardy or half-hardy tufted plants, with long, narrow, sword-shaped, radical leaves, and tall scapes, often five feet high, surmounted by brilliant, densely packed floral spikes, of drooping, tubular flowers. They like a light, deeply dug, well-drained soil, and a warm and sheltered position. The best known and most cultivated species, *K. aloides,* from South Africa, has many varieties, and bears in early autumn spikes of red, orange, and yellow.

Flame-Thrower, a long-handled device fitted with a special nozzle for directing flame in any desired direction. Pressure flame-throwers, burning gasoline and other liquid fuel, are regularly used by railroads in keeping switches and frogs free from ice; during the summer season, similar mechanisms mounted on rail-cars keep the right-of-way free from obnoxious weeds. Orchardists, using flame-throwers mounted on long poles, rid infested trees of caterpillar pests in much the same manner. During the Second World War in 1940, the German army made some use of portable flame-throwers and flame-throwing tanks in attacking fortifications.

Flamens, flā'mens, were priests in ancient Rome, devoted each to some special deity. There were fifteen in all.

Flamingo, fla-ming'gō (*Phœnicopterus*), a bird structurally intermediate between ducks and geese on the one hand, and storks and herons on the other. The special peculiarity of the flamingo lies in the structure of the bill, which is large and abruptly bent down at the middle point. The upper jaw is broad, flattened, and freely movable; the lower, deep, channelled, and almost immovable. The legs are exceedingly long, as is also the neck, and the plumage is always pinkish or scarlet. The birds wade in the water, stirring up the bottom with restless feet, and grub for small animals. In thus fishing, the neck is bent upon itself so that the upper half of the spoon-like bill is turned downward. The edges of both upper and lower jaw are furnished with small transverse plates, which serve for a sieve, allowing the escape of the mud, but retaining the small worms, crustaceans, molluscs, fishes, etc., on which the birds feed. The upper surface of the tongue is beset on the sides and base with flexible, recurved, horny spines.

The flamingoes are birds of powerful flight, and fly like geese in strings or wedge-shaped flocks. They also swim in deep water, but the legs are too long to be well adapted for this purpose. They are habitual waders, and the webbed membrane of the feet helps to support them on soft, muddy bottoms. They nest on remote coasts and islands in the tropics, making elevated nests of mud, upon which they sit with folded legs—hundreds of nests being placed close together. The nesting occurs about the end of May, the hatching about a month later. There is usually only one egg. The genus Phœnicopterus includes eight or nine species, four of which are American (in Chile, Galapagos, Mexico, West Indies), while the others are distributed in Africa, Southern Europe, India, and Ceylon.

Photo by Schubert

FLAMINGOES AND THEIR IMAGES

Flaminian Way, fla-min'i-an (*Via Flaminia*), the great road from Rome to the north of Italy. It owed its name to the democrat

C. Flaminius, who was censor in 220 B.C.; but the first part of it, from Rome, crossing the Tiber by the Milvian bridge (the Ponte Molle), through Otricoli to Narnia, had been constructed probably about 300 B.C., and in 240 B.C. had been continued from Narnia to Spoletium. Flaminius prolonged it by the village of Forum Flaminii, through the pass of Furlo, to Fanum on the Adriatic coast, and thence to Ariminum, the great northern frontier fortress. It was the first road to cross Italy from sea to sea.

Flamininus, TITUS QUINTIUS (*c.* 228–*c.* 174 B.C.), was consul in ancient Rome in 198 B.C., and defeated Philip v. of Macedon in the decisive battle of Cynoscephalæ (197 B.C.), which led to peace.

Flaminius, CAIUS, a Roman statesman of the popular party, who was tribune in 232 B.C., in which year he carried an agrarian law; consul in 223, when he defeated the Insubrian Gauls; and censor in 220, when he was responsible for the Flaminian circus and road, which ran northwards from Narnia to Ariminum. In 217 he was consul a second time, and was entrapped by Hannibal at the battle of the Trasimene lake, where he perished with most of his army.

Flammarion, CAMILLE (1842–1925), French astronomer, born at Montigny-le-Roi, he entered the Paris Observatory (1858), worked for four years in the Bureau des Longitudes, then edited successively *Cosmos* and the scientific department of the *Siècle*. His first book was *La Pluralité des Mondes Habités* (1862; 34th ed. 1890); in *Voyages en Ballon* he described his balloon ascents (1868), and published in 1889 a scientific romance entitled *Urania* (Eng. trans. 1891). Of more permanent value are his *Catalogue des Etoiles Doubles* (1878), *Les Etoiles et les Curiosités du Ciel* (1881), and *La Planète Mars* (1892). He founded, in 1882, the monthly periodical *L'Astronomie*, and had a fine observatory at Juvisy, near Paris. To the general public Flammarion is best known as a brilliant popularizer of astronomical subjects, and the author of, among other works, *Astronomie populaire* (1880; Eng. trans. 1894); *Les Merveilles célestes* (1865; trans. 1870); *Lumen* (1873; trans. 1897); and *Etudes et Lectures sur l'Astronomie* (9 vols. 1867–80). See *Life* in French by S. Hugo (1891).

Flamsteed, JOHN (1646–1719), English astronomer-royal, was born near Derby. The execution of his early project to rectify the tables of the heavenly bodies was officially committed to him by a royal warrant in 1675, appointing him 'astronomical observator' to Charles II., and Greenwich Observatory was built for him the next year. He labored at the reform of astronomy for the improvement of navigation until his death. His observations, imperfectly issued against his will in 1712, were posthumously edited by his assistant, Joseph Crosthwait, in 1725, in the three volumes of the *Historia Cœlestis Britannica*, the third containing the *British Catalogue* of 2,935 stars.

Flanders (Flem. *Vlaenderen*), the country of the Flemings, long an autonomous countship of Europe, sometimes partly under the suzerainty of France, and sometimes partly under the suzerainty of the empire, but in point of fact generally independent and self-governing. For the most part it embraced the region fronting the North Sea from the northern arm of the Scheldt to the Somme in France. From the middle of the 11th century down to 1477 the countship of Hainault was almost continuously united with it. Since the 1st century, when it formed part of the Roman province of *Belgica Secunda*, this region has been distinguished for its industrial towns, remarkable for their large populations and powerful democratic rule. Industrially and politically these cities, especially Ghent (Flemish,Gent), Bruges (Brügge), Ypres (Yperen), Courtrai (Kortrijk), Roulers (Roselaere), Valenciennes, Tournai (Doornijk), Lille (Rijsel),and others, were most famous from the middle of the 10th century to the middle of the 16th century, when Spanish rule became supreme, and to a great extent extinguished their prosperity. The salient events of these six hundred years, and of the two hundred years preceding, may be briefly summarized as follows. The district around Bruges and Sluys was in the 7th century called *municipium Flandrense;* this was the nucleus of the future countship of Flanders, which was not created until 862, and was at first a fief of the crown of France. The woollen industry, the foundation of the industrial power of the Flemish cities, was introduced into the country by Count Baldwin III. in the middle of the 10th century. In 1007 the Count of Flanders acquired in fief certain territories (Ghent,the islands of Walcheren, Beveland , etc.), which were subject to the suzerainty of the emperor. Baldwin IX. (1194–1206) took the crusader's cross, and became the first king of the Latin empire of Constantinople. From the early years of the 13th century down to the year 1477, the most prominent feature in the political history of Flanders was the persistent endeavor made by the French kings to obtain a preponderating influence in the country. In this they were zealously assisted by the nobles of Flanders, and generally by the ruling counts, but were strenuously and successfully resisted by the democratic and national party—that is, by the Flemish people. One of the most dramatic incidents of this struggle was the battle of the Golden Spurs, fought near Courtrai on July 11, 1302, in which the valiant weavers of Bruges, Ghent and Ypres utterly routed, with great slaughter, the proud chivalry of France. All through the middle of the 14th century (1336–82) the destinies of Flanders were guided by James and Philip van Artevelde, the most influential citizens of Ghent. The former found a counterpoise to the threatening French influence in Edward III. of England, the country which then principally fed the Flemish looms with wool and woollen yarn. In 1385 the marriage of the heiress of the last Count of Flanders to the Duke of Burgundy united the fortunes of the countship to those of Burgundy. In this way Flanders became eventually part of the dominions of Austria, and subsequently of Spain, except the Dutch portion of the countship, which had been transferred to Holland as far back as the year 1256. At various periods between 1659 and 1713 the French succeeded in gaining the several districts which are now described as French Flanders; while the rest of the countship eventually fell into the power of the French republican armies in 1794, and at the treaty of Vienna (1815) was incorporated in the new kingdom of the Netherlands. And its last political transference was made in 1830, when the core of the ancient countship was assigned to the kingdom of Belgium.

The Flemings are, broadly speaking, descended from Frankish tribes, who settled in this part of Europe in the 4th and succeeding centuries, but modified by strong strains of Belgic (ancient Gallic) and Saxon (Low German) blood. Their language may be briefly described as southern Dutch. In its essential characteristics — vocabulary, structure, and grammar—it bears a very close resemblance to Dutch, especially to middle Dutch; but in details, choice of idioms, and turns of expression, it exhibits a certain measure of independence. As compared with classic Dutch, Flemish gives the impression of being an uncultivated, unliterary tongue. Nevertheless it has a considerable literature, already dealt with under BELGIUM (*Literature*). See Kervyn van Let-

tenhove's *Histoire de Flandre* (5th ed. 1898), and Pirenne's *Geschichte Belgiens* (1899–1902).

The term is now applied to two Belgian provinces. (1.) EAST FLANDERS, in the w. of Belgium, drained by the Scheldt and the Lys. It is level and low, well cultivated and fertile, and is famous for its flax and its linen; it produces also cotton, cloth, paper, leather, and cattle. Area, 1,147 sq. mi. Pop. (est. 1938) 1,192,034, giving a density of 1,039 inhabitants per square mile. The people are mostly of Flemish stock, Roman Catholics, and moderately educated. Chief city, Ghent. (2.) WEST, the most westerly province of Belgium, abutting upon the North Sea. Low, flat, and of rich fertility, the region produces tobacco, flax, and hops. The principal industries are farming, dairying, fishing, and lace and linen manufacture. Area, 1,248 sq. mi. Pop. (est. 1938) 965,910, giving a density of 774 people per square mile. Chief city, Bruges; principal port, Ostend.

See BELGIUM; GREAT WAR OF EUROPE; WORLD WAR, THE SECOND

Flandrin, HIPPOLYTE (1809–64), French painter, born at Lyons; proceeded to Paris (1829), and was a pupil of Ingres. After winning the Prix de Rome with *The Recognition of Theseus* (1832), he became the fashion, and was much employed in the decoration of public buildings. Notable examples of his work are the fresco series, *Christ going up to Jerusalem* and *Christ going to Calvary*, and a successive series taken from the Old and New Testaments and from the Saints and Virtues, in the church of St. Germain-des-Prês, Paris. Other examples may be seen in the churches of St. Paul at Nîmes, St. Martin d'Ainay at Lyons, and St. Vincent de Paul in Paris. He also won success as a portrait painter. See *Life* by Poncet (1864), also by Montrard (1876). See Flandrin's *Lettres et Pensées*, edited, with biography, by Count David de la Borde (1865).

Flange, in mechanical engineering, a projecting flat rim or collar, used to strengthen the object of which it forms a part, to provide a suitable means of attachment to another object, or, acting as a guide, to assist in maintaining their correct relative positions. The flanges of girders offer an illustration of their use for strength alone; the top and bottom horizontal members (which bear that name) being composed of plates, riveted on to the connecting vertical diaphragm or web. Similarly steel beams, of whatever sectional form, owe their stiffness and strength to their combination of flanges and web. Cast-iron pipes may be joined together by bolts, passing through the flanges at the ends of each. The component parts of machines are connected in a similar way.

The tunnels for deep-level electric railways are lined with series of rings of cast iron, each composed of a number of segmental plates. These are cast with flanges at their sides and ends, four or five inches deep, and of the same thickness as the plates. Bolts connect rigidly the flanges of adjacent plates after erection, so that the finished tunnel exhibits a series of interior circumferential ribs, which greatly strengthen it.

The wheels of railway carriages or street cars are kept to the track by vertical flanges on their tires, bearing against the rails.

Flannan Islands, or SEVEN HUNTERS, group of seven small uninhabited islands, Ross-shire, Scotland, in Uig par., Outer Hebrides, 21 m. N.W. of Gallon Head, off w. coast of Lewis. They are the *Insulæ Sacræ* of Buchanan, and contain Culdee remains. Numerous sea-fowl, eider-ducks, and gannets breed on the islands.

Flannel, a variety of soft, woollen textile. Flannels are made of woollen yarn, slightly twisted in the spinning, and of open texture, the object being to have the material soft and spongy, without regard to strength. Usually cotton, linen or silk is combined with the wool. Such as have the pile raised on one side (which is effected by teasels or by cards, and called *perching*) are termed 'raised flannels'; when both sides are so covered they are 'double-raised flannels.' There are also 'milled' and 'double-milled' flannels; and all the varieties are often dyed or printed, though many are solid white. Flannels are bleached by the fumes of burning sulphur.

Flash Point is the temperature to which an oil must be heated to give off vapor that will catch fire if ignited. The temperature at which this occurs, depends very much on the apparatus employed, being far higher in an open vessel than in a closed one. As there are legal restrictions in most countries as to the storage, etc., of oils of low flash points, the apparatus to be employed is specified. In Germany and Great Britain, Abel's ('closed oil tester') is the legal standard. It consists of a cup, in which the sample of oil is heated by a water bath to a temperature indicated by a thermometer, a flame being applied at regular intervals to an opening, that is usually closed by a sliding lid, in the cover of the cup, till the vapor rising from the oil gives a blue flash. It is also used in the U. S., though the open tester is generally employed, but has the disadvantage of not realizing as perfectly the conditions of a simple lamp. It consists of a water bath in which the oil is heated and a delicate thermometer to measure the temperature. The temperature at which the oil ignites when a flame is passed a half inch above the surface is the flash point. Each state in the U. S. has its legal standard, the usual point specified being 110° F., though in some cases 150° F. is specified as the open cup flash test. It should never be under 100° F. In Great Britain the minimum legal flash point is 73° F. with the closed tester, taking the place, according to the Petroleum Act of 1879, of the older open test of 100° F. It is a matter of considerable discussion as to whether the present minimum flash point should not be raised.

Flat in music is the name given to the sign ♭, which signifies that the note before which it is placed is to be lowered a semitone. Two of these signs, ♭♭, are termed a *double flat*, and indicate that the note they prefix must be lowered two semitones.

Flatbush, a former tnship. of Kings co., N. Y., a residential section of Brooklyn.

Stages in the Growth of a Flatfish.

Flatfish means the members of the family Pleuronectidæ, in which the body is flattened from side to side, instead of from above downwards, as in skate and ray. This family embraces the turbot, sole, plaice, flounder, and halibut. The flatfish chiefly haunt sandy and gravelly shores, being absent where the coast is rocky. The young forms occur in the open sea, and are perfectly symmetrical in shape. As they grow older, the body becomes laterally compressed, and the fish, instead of swimming in the vertical plane, turns over on one side. The eye of this side travels gradually round till it comes close to the other eye, and the fish has then a blind side, which is directed downwards, and is not pigmented, and an upper side, strongly pigmented, and possessing two eyes. The change of position of

the one eye is accompanied by a marked distortion of the skull, which becomes symmetrical. At the same time changes take place in the position of the dorsal fin, which often grows forward, so as to separate the eyed from the blind side of the head. Both it and the anal fin are long and undivided. The air-bladder is absent. Of recent years the flatfish have attracted great attention in connection with the problem of the inheritance or non-inheritance of acquired characters. See FLOUNDER.

Flat Foot, or PES PLANUS, an acquired deformity associated especially with youth, weak general health, and over-pressure upon the feet. It is commonest in young people whose daily work entails long hours of standing. The muscles supporting the arch weaken, gradually losing their tone. Without the support of the muscles, the ligaments stretch and the bony arch flattens. When the patient stands barefooted, the arch is seen to be breaking down and the foot is flattened out on the inner side. In bad cases the foot is strongly everted (*i.e.* the toes are always turned out), and the outer edge of the sole may even be raised slightly from the ground.

In slight cases treated early, rest and special exercises are of value. Much help may also be obtained from a false sole in the shoe, with a pad supporting the arch on the inner side. In cases of eversion some surgeons advocate the removal of a wedge of bone from the inner side of the foot. When there is any tendency to flat foot, high heels are particularly harmful, as they throw the centre of gravity forward, and increase the strain upon the arch.

Flatheads, an Indian tribe, residing in the vicinity of Flathead Lake, Montana. It is not known how this name came to be applied to them, because they never seem to have practised the head deformation of the Chinook and other western tribes. They made use of the buffalo skin tent of the Plains Indians when on the hunt, but at other times they lived in bark-covered huts. In early times they were noted for the possession of a large number of horses. They are now confined to a reservation in western Montana. In language they are of Salish stock.

Flat Island. See SEYCHELLES.

Flatman, THOMAS (1637–88), English poet and miniaturist, was born in London. His miniatures are more esteemed than his Pindaric odes, religious verses, and translations. His *Poems and Songs* were published in 1674 and 1686.

Flattery, CAPE, headland at the entrance to the Straits of San Juan de Fuca and the extremity of Clallam county, Washington.

Flatulence, a term used in medicine for distention of the stomach or intestine by flatus or gas. It is generally due to faulty digestion, but sometimes to mechanical obstruction, and occasionally to the chemical action of drugs which produce effervescence. It may be of hysterical origin.

The treatment must depend upon the cause. When due to fermentation of food in the stomach, it may be relieved by abdominal massage, draughts of hot water, hot applications over the stomach, and carminatives, such as cloves, peppermint, and ginger, internally. If it is intestinal, and not due to such serious obstruction as volvulus or hernia, enemata and aperients are useful. Preventive measures are moderation in the use of starchy foods (bread, potatoes, etc.), and in some cases the diminution of or abstention from fluid during meals. In the flatulence of infants, a hot bath may give temporary relief, but in most cases a change in the type of feeding bottle is advisable. Small doses of asafœtida are useful in hysterical distention. In all cases free daily evacuation of the bowels should be secured.

Flat Worms, See PLATYHELMINTHES.

Flaubert, flō-bâr′, GUSTAVE (1821–80), French novelist, was born in Rouen, where he spent the greater part of his life. From 1847 to 1851 he travelled in Brittany, Greece, Egypt, Asia Minor, and some of the islands of the Mediterranean; and in 1858 he visited the site of the ancient Carthage. His first work, *Madame Bovary* (his greatest novel), appeared in the *Revue de Paris* in 1857, and led to the unsuccessful prosecution of the author for an offence against morals. It served also to secure for him the friendship of Gautier and his set, the Goncourts, Gavarni the artist, and others. In 1862, Flaubert published the historical romance *Salammbô;* in 1869 *L'Education Sentimentale*, a realistic novel, after the type of *Madame Bovary;* in 1874 *La Tentation de St. Antoine*, a historical romance; in 1887 *Trois Contes*, three short stories, of which the first is modern, the other two are historical. *Bouvard et Pécuchet*, a novel, was left unfinished at his death.

The root-idea of Flaubert's work seems to be that things external to the writer (including in this term the emotions of others—all the material, that is, for the novelist) have in some Platonic region of ideas their perfect form of expression. The greatest writer, consequently, is he who makes himself the subtlest instrument for receiving impressions from these outward things, and rendering such impressions in the perfect—because aptest—literary language.

In addition to his novels, all of which have been translated into English, Flaubert wrote two dramas—*Le Candidat* (1874), and *Château des Cœurs; Par les Champs et par les Grèves*—a tour in Brittany (1847); a study on *Rabelais; Lettres à George Sand* (1884); and three volumes of *Correspondence* (1887–93), preceded by a memoir from the pen of his niece, Caroline (Hamard) Commanville. His *Œuvres Complètes* appeared in eight volumes. Consult *Lives*, in French, by Faguet, P. Bourget, and Ten Brink.

Flavel, JOHN (?1630–91), English Presbyterian divine, was born in Bromsgrove in Worcestershire. He became minister at Diptford (1650), afterwards at Dartmouth, and as an ejected minister, and under the Five Mile Act, at Slapton, where he was followed by his sympathizing parishioners of Dartmouth. Finally, however, he took up his abode at Dartmouth, where he ministered to his congregation until his death. Flavel was a prolific writer, his works being mostly sermons on doctrinal topics.

Flavia Gens, the Flavian clan of ancient Rome, famous as that of the emperors Vespasian, Titus, and Domitian. In later times the name Flavius was borne by all the emperors of the house of Constantius Chlorus, father of Constantine the Great.

Flavine, a concentrated preparation of quercitron bark. Formerly an important yellow dye, it has been largely replaced by cheaper coloring materials.

Flavorings are substances of characteristic taste and odor used in cooking, to render dishes more agreeable to the palate. Among those in most common use are oil of bitter almonds, oil of lemon, vanilla, saffron, essence of peppermint, essence of cloves, angelica, coriander, cloves, caraway, nutmegs, allspice, cardamoms, ginger, cassia, mace, garlic, shallots, tarragon, chives, thyme, parsley, sage, mint, anise, capers, pepper, dill, chervil, fennel, marjoram, horse-radish, mustard, and the numerous artificial essences resembling more or less nearly the flavors characteristic of various fruits. See articles on the various flavoring substances as ALMONDS, OIL OF LEMON OIL; etc., etc.

Flax (*Linum*), the typical genus of Linaceæ, a sub-order of

the Geraniaceæ, including more than one hundred species of annual and perennial herbaceous plants, with a few small shrubs, all inhabitants of temperate climates. The most important of these is the Common Lint or Flax (*L. usitatissimum*), cultivated since ancient times for its fibre, which is spun into linen (q. v.), and for its seed (see LINSEED).

The Common Flax is an annual herbaceous plant; the stalk—the source of the fibre—is erect, 2 or 3 feet in height, and branched only near the top; the leaves are narrow and lance-like; and the

Flax

a. Seed flax. *b*. Fibre flax.

flowers, which are borne in corymbs, are bright blue in color, with five petals and five sepals. The sepals are persistent, but the petals fall early. The fruit is a round boll divided into a number of cells in which are the smooth heavy seeds—the linseed of commerce.

There are two distinct varieties of flax grown—one primarily for seed, and the other for fibre. Seed flax is grown very largely as a breaking crop on the prairies of the Western United States, where nearly two million acres have been in cultivation for a number of years. It is also grown extensively in the Argentine and India. This flax is sown broadcast from forty to fifty pounds to the acre, and is harvested with a header, or a machine which cuts the heads off the plant, leaving a long stubble. The fibre from the broken straw is used for upholstery tow and paper stock.

Flax grown primarily for fibre requires special pedigreed seed, and a good sandy loam, free from weeds. A firm, smooth seed bed should be prepared by plowing in the fall and disking and harrowing about ten days before planting. The seed should be sown broadcast, 80 to 90 pounds to the acre, and covered with not more than one half inch of soil by a light harrow, and the ground should then be rolled. Flax should be rotated at least once in four or five years, preferably with potatoes, beans, vetches, or some nitrogenous plant.

The flax plant matures in from eighty to ninety days, and should be harvested when the leaves on the lower portion of the stalk begin to turn yellow. Formerly the crop was harvested by being pulled up by the roots, a method which originated with the Egyptians, who grew their flax on the Nile Delta. A special mower has recently been devised, however, which cuts the flax less than one inch from the ground, and does away finally with the tedious and expensive process of hand pulling. Formerly the seeds were separated from the flax by drawing the plant through a heavy comb, but methods have been introduced whereby the seed is removed by rollers through which the seed heads of the flax are passed. This seed is then cleaned by machinery, and the straw is stacked and dried preparatory to separating the fibre. For subsequent treatment see LINSEED; LINEN.

Statistics. — According to a statement by the U. S. Department of Agriculture, the world's annual production of flax fibre, under normal conditions, is 800,000 tons. The acreage annually devoted to the crop is about 4,000,000. Prior to the Great War Russia produced about four-fifths of the entire crop, with Austria-Hungary, France, Ireland, Belgium, and Holland following. Smaller amounts are grown in Germany, Italy, Roumania, and Japan. Little fibre flax is raised in the United States, though the climatic conditions are excellent and American grown flax compares favorably with the foreign product. The seed crop is considerably larger.

Bibliography.—Consult *Flax for Seed and Fibre*, and *Fibre Flax* (*Farmer's Bulletins No. 27* and *669*, U. S. Department of Agriculture); Dodge's *Dictionary of the Fibre Plants of the World;* also references under LINEN.

Flax, NEW ZEALAND (*Phormium tenax*), a liliaceous plant bearing tough, radical leaves usually about four feet in length. It is half-hardy, and in early autumn bears large reddish or yellow flowers, with tubular perianths. The plant yields a valuable fibre, which is stripped by machinery, and used for making baskets, ropes, etc.

New Zealand Flax.

1, Flowers; 2, fruit.

Flaxman, JOHN (1755–1826), English sculptor, was born at York. In 1767 and 1769 he exhibited models at the Free Society of Artists, and in the latter year he was admitted a student of the Royal Academy, whose silver medal he won in 1770, when he began to contribute to its exhibitions. From 1775 till 1787 his chief source of income was the Messrs. Wedgwood, whom he furnished with exquisite designs and decorations for their pottery, work for which he was admirably fitted by his skill in modeling in relief.

He was in Italy from 1787 to 1794, and there executed his celebrated outline illustrations to Homer, Æschylus, and Dante. He was elected an associate of the Royal Academy in 1797; in 1800 he became a full member, and in 1810 was appointed professor of sculpture. His groups of *Cephalus and Aurora*, *Michael and Satan*, his *Psyche*, his monument to Lord Mansfield (Westminster Abbey), and his *Shield of Achilles*, a late work, are among some of his best-known productions; others are his monuments to Nelson, Howe, and Reynolds, in St. Paul's Cathedral, and numerous exquisite bas-

reliefs, scriptural in subject, at Buckingham Palace. His work, which had a powerful influence on his younger contemporaries, was mostly classical in spirit, rich in fancy, and notable for nobility of conception and purity of line. Collections of his sculptures and sketches are in University College, London, the British Museum, the South Kensington Museum, Cambridge, and in Glasgow. His lectures on sculpture are published in book form. See Sir S. Colvin, *Drawings of Flaxman, in 32 Plates, with Descriptions, and an Essay on His Life and Genius* (1876); W. G. Constable, *John Flaxman* (1927).

Fleabane, certain plants belonging to the genera Erigeron and Pulicaria (Compositæ). The

Fleabane (Erigeron).

common fleabane (*P. ulicaria dysenterica*) of Europe is a perennial plant often to be found growing in damp ground. It is usually found in masses, the plant commonly growing to a height of about twenty inches. It has sagittate leaves, and both stems and leaves are downy. In early autumn it bears bright yellow heads of flowers. See Erigeron.

Fleas are insects which are to be regarded as flies modified for a parasitic life, although they are placed in a separate order as Aphaniptera ('inconspicuous wings'). They have no wings, and mouth parts are adapted for piercing and sucking, the legs, especially the last pair, are long, strong, and fitted for jumping; the larva is minute and worm-like, and has the mouth parts adapted for biting. The common flea (*Pulex irritans*) is a very typical example, its compressed body, with the smooth, hard, and nearly naked skin, being an adaptation to its special mode of life. Many species of fleas are known, not a few birds and mammals having their own characteristic forms. The adults apparently feed only on blood,

Common Flea (much enlarged).

but, as in the case of some other blood-sucking insects, they can exist for a prolonged period under conditions where it is difficult to believe that this diet can be available. The larvæ probably feed on decaying organic matter, and are found among dust and refuse. For the formidable giant American flea, see Chigoe.

Flèche, La, tn., dep. Sarthe, France, on the Loir, 25 m. s.s.w. of Le Mans. Its military school for officers' sons occupies the site of a 16th-century Jesuit school. Oil, leather, starch, gloves and paper are manufactured. Pop. (1926) 7,206.

Flecknoe, Richard (d. 1678?) an Irish Roman Catholic priest, was in early life a great traveller, in Europe and America, and subsequently a writer of plays, poems and prose; but only one of his plays, *Love's Kingdom,* was ever performed. His memory has been preserved by Dryden's great satire, *MacFlecknoe* (1682).

Fleet Prison, an historic London prison, formerly situated on the east side of Farringdon Street, dated from Norman times. It was burned down in 1666; rebuilt, destroyed in the Gordon riots of 1780 and again rebuilt in 1781. It was the prison for those convicted under the Star Chamber and the Court of Chancery. On the abolition of the Star Chamber (1640), it became the home of debtors, bankrupts, and those charged with contempt of court. Here were confined Lord Surrey, the poet; Bishop Hooper, the martyr; Prynne, who lost his ears for *Histriomastix;* Wycherley, the poet; Savage, the poet, and friend of Johnson; and Penn, afterwards of Pennsylvania. Irregular marriages, or those without a license, were performed by a priest in this prison, and were held to be legally binding, the system being perfectly organized early in the 17th century.

Fleetwood, seapt. in Lancashire, England; 20 m. s. w. of Lancaster. The town is named after Sir P. H. Fleetwood, who from 1836 converted a rabbit warren into an active fishing port and health resort. Pop. (1931) 22,983.

Flegel, Eduard Robert (1855–86), German traveler, an explorer of W. Africa, born at Vilna, formerly Russia. After a journey up the Niger and Benue in 1879, he was (1880) dispatched by the German African Company on the expedition to those rivers. Flegel was then (1885–6) employed by the German government on the exploring and political mission to the country lying between the Benue and the Cameroons, but found himself forestalled by Joseph Thomson and other English agents, and died at Brass in the Niger estuary. He wrote *Vom Niger-Benue* (1890).

Fleischer, Heinrich Lebrecht (1801–88), German Orientalist, born at Schandau (Saxony). He was first employed as assistant in the Royal Library at Dresden, and was then elected to the chair of Oriental languages at Leipzig (1836), which he held until his death. His publications include *Historia Anteislamica* of Abulfeda (1831–4); *Dissertatio critica de glossis Habichtianis in IV. priores tomos MI. Noctium* (1836); *Alis Hundert Sprüche* (1837); and he edited Beidhawi's Commentary to the Koran (1846–48), and many Arabic and Persian classics. See *Life* by F. A. Mueller, trans. by H. Szold for the Smithsonian Institution's report (1892).

Fleming, John (1785–1857), Scottish naturalist, born near Bathgate in Linlithgowshire. The first zoologist of his time in Scotland, he wrote *The Philosophy of Zoology* (1822), wherein he criticised the classification of Cuvier and discussed the characters of animals. He also wrote *British Animals* (1828). In 1832 he was elected to the chair of natural philosophy in Aberdeen, where the Old Red Sandstone and its fossils engaged his attention; and in 1845, as he had seceded from the Church of Scotland at the disruption (1843), he accepted a similar appointment from Dr. Chalmers in the Free Church College of Edinburgh. He also wrote *The Temperature of the Seasons* (1851), and *The Lithology of Edinburgh* (1859).

Fleming, Sir John Ambrose (1849–), English electrical engineer, born at Lancaster. When the Edison Electric Lighting Company was formed, he was appointed their electrical engineer, and superintended the introduction of incandescent lighting into England. The erection of the present engineering and

electrical laboratory at University College, London, was due to him, and he is regarded as one of the first experts on electrical matters. He was awarded the Faraday Medal of the Institution of Electrical Engineers (1928), the Duddell Medal of the Physical Society (1930), and a number of other decorations. His publications include *Short Lectures to Electrical Artisans* (1885); *A Handbook for the Electrical Laboratory and Testing Room* (1901); *The Wonders of Wireless Telegraphy* (1913); *Fifty Years of Electricity* (1921); *Electrons, Electric Waves and Wireless Telephony* (1923); *The Interaction of Scientific Research and Electrical Engineering* (1927); and numerous scientific papers.

Fleming, MARGARET (1803–11), a Scottish juvenile prodigy, called 'Pet Marjorie,' was born at Kirkcaldy, Fifeshire, and was the pet of Sir Walter Scott. This infant prodigy was acquainted with history at six years of age; kept diaries, and wrote verses, including a historical poem upon *Mary Queen of Scots,* at seven. She died from an attack of measles.

Fleming, PAUL (1609–40), German poet, born at Hartenstein in Saxony. He accompanied embassies sent by the Duke of Holstein to Russia and to Persia; and on his return from the second stayed in Leyden, and died at Hamburg on his way home. His poems were first published in 1642 (*P. Flemings Teutsche Poëmata*). F. Straumer has written a popular sketch of Fleming's life (*Paul Flemings Leben und Orientalische Reisen,* 1892); and he is also the subject of a dissertation, in Latin, by L. Wysocki (1892). A selection of his works was edited by H. Oesterley (*Kürschners Deutsche National-Literatur,* vol. xxviii).

Fleming, SIR SANDFORD (1827–1915), Canadian engineer, born at Kirkcaldy, Fifeshire. He settled in Canada (1845), and in 1852 was employed on the Northern Ry., then known as the Ontario, Simcoe, and Huron. He was one of the engineers who first made surveys for a Canadian transcontinental railway, and took an active part in the promotion of a state cable between Canada and Australia (opened in 1902). In 1897 he was made a K.C.M.G. He was president of the Royal Society of Canada, 1888–9. He represented Canada at the International Prime-meridian Congress at Washington, D. C., in 1884. His publications included *The Inter-colonial: A History,* 1832–76 (1876); *England and Canada* (1884); *A Memorable National Epoch* (1908); *The Beginning of the Empire* (1910).

Flemings. See FLANDERS.

Flemington, vil., N. J., co. seat of Hunterdon co., 52 m. S.W. of N. Y. C., on the the Cent. of N. J. the Lehigh Valley and the Pa. R. Rs. The principal manufactures are foundry products, stoneware, and cut-glass. Farming is carried on extensively and fruits, especially peaches, are raised. It was first settled in 1735. The sensational trial of the Lindbergh kidnap case (q. v.) was held in Flemington court house, Jan.–Feb. 1935. Pop. (1930) 2,729.

Flemington and Kensington, suburb of Melbourne, Victoria, Australia, has one of the finest racecourses in the world. The cattle-markets are important.

Flemish Bond. See BRICKLAYING.

Flemish Language and Literature. See BELGIUM.

Flensburg, seapt. tn., prov. Schleswig-Holstein, Prussia; at the head of Flensburg Fjord, 20 m. N.W. from Schleswig. It does a large trade in agricultural and forest products. Pop. (1933) 66,580.

Flers, tn., dep. Orne, France, 41 m. S. of Caen. It has important linen and cotton manufactures. Pop. (1926) 10,756.

Fletcher, ALICE CUNNINGHAM (1845–1923), American ethnologist, born in Boston, Mass. She made archæological investigations in the Ohio and Mississippi valleys, and becoming an assistant of the Peabody Museum at Cambridge, Mass., in 1882, was sent by that institution to reside among the Omaha Indians for the purpose of observing their manners and customs. The following year she induced many of their children to attend the Indian schools at Hampton and Carlisle. With the coöperation of the Woman's National Indian Association, Miss Fletcher originated the system of enabling Indians to obtain land and erect houses with the aid of small loans. On several occasions she was appointed special U. S. agent for the allotment of land to the Indians; and she was sent to Alaska and the Aleutian Islands by the U. S. Commissioner of Education to examine the conditions of the Indians in those districts. She was a juror in the ethnological section at the Chicago Exposition of 1893, and was a member and officer of learned societies. Besides her important contributions to scientific publications, she wrote *Indian Story and Song from North America* (1900), the material for which she personally obtained among the Indians of the west, and which contains some of the most important notations of Indian music yet secured.

Fletcher, ANDREW, OF SALTOUN (1655–1716), Scottish politician, born at Saltoun, East Lothian. On the death of his father (1664), the boy was placed under the tuition of Gilbert Burnet, then minister of Saltoun and afterwards bishop of Salisbury. He was elected to the Scottish Parliament for East Lothian (1678); but, on account of his opposition to the ecclesiastical policy of the government, he had soon to take refuge in Holland. In Monmouth's expedition (1685) he commanded the cavalry under Lord Grey of Wark; but having in a quarrel shot one of his fellow-refugees dead, he had to make his escape to the Continent, where he had a variety of adventures before he joined William of Orange at the Hague (1688), and returned to Scotland. After 1703 he took a prominent part in politics, his aim being to preserve as far as possible the independent authority of Scotland in matters affecting its own interests. He was also one of the chief projectors of the disastrous Darien colonization scheme, and likewise the advocate of a variety of ingenious methods for promoting the internal prosperity of the country. The union with England had in him one of its most strenuous opponents. In his later years he mainly devoted himself to the improving of Scottish agriculture. He died in London. He was the author of *Two Discourses Concerning the Affairs of Scotland* (1698); *A Discourse of Government Relating to Militias* (1698); *An Account of a Conversation Concerning a Right Regulation of Governments for the Common Good of Mankind* (1704). His *Collected Works,* with *Life,* appeared at London in 1737. An *Essay* on his life and works, by the Earl of Buchan, was published in 1792; and a *Life* (1897), by G. W. T. Omond, is included in the Famous Scots Series.

Fletcher, BENJAMIN, colonial governor of New York from 1692 to 1698. The dates of his birth and death are unknown. He befriended the Indians against the French, and by them was called 'Great White Arrow'; but he found it difficult to unite his own people in defence of the frontier. He quarrelled with the Connecticut colony over his control of their militia, and with William Penn over the government of Pennsylvania which he had been commissioned to take, at the instigation of Penn's enemies. Against the protest of the council, he summoned the assembly which en-

acted and collected a tax for the defence of all the colonies. Upon his return to New York he was opposed and condemned by political and religious factions and accused of protecting Kidd and other pirates to his own profit. Besides protecting piracy, he was charged with accepting bribes, and interfering with elections both by force and corruption. He was finally deposed. He was an ardent champion of the Anglican Church, built a chapel in New York, which was burned, and subsequently Trinity Church on 'King's Farm,' where the present building of that name now stands. He was zealous, and reckless in provoking criticism and hostility.

Fletcher, GILES (?1588–1623), English poet, was born in London, and became reader in Greek (1615–18) at Cambridge. His poetry, religious in character, was written in early life, under the influence of Spenser, and in its turn influenced Milton. He took orders and retired (*c.* 1618) to a college living, whence he moved to that of Alderton, Suffolk. Poems: *Christ's Victory and Triumph* (1610; ed. A. B. Grosart, 1868, 1876; ed. W. T. Burke, 1888), etc. Prose: *The Reward of the Faithfull* (1623).

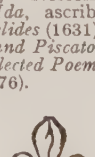
Fletcher, HORACE (1849–1919), American author and lecturer, was born in Lawrence, Mass., and graduated at Dartmouth College in 1870. At an early age he began his world travels, in which he engaged for many years. After 1895 he devoted special attention to sociology with relation to scientific nutrition and research in the chemico-physiological laboratories at Cambridge, England, and Yale University. Among his publications are: *Menticulture* (1897); *Happiness* (1900); *Nature's Food Filter; or, What and When to Swallow* (1901); *Glutton or Epicure* (1902).

Fletcher, JOHN (1579–1625), English dramatist, was born at Rye, Sussex. His collaboration as a dramatist with Francis Beaumont (1584–1616) began about 1607. The two are said to have lived together on the Bankside in Southwark in the closest literary and personal relations. After Beaumont's death Fletcher continued to write for the stage, often with Massinger and other playwrights. The investigations of Mr. Fleay, Mr. Boyle, and others into the characteristic styles of the writers concerned in the plays have led to results which are accepted in the main by Professor A. W. Ward, and largely agree with the conclusions formed upon more general grounds of taste by Mr. A. H. Bullen. The following classification may be regarded as based on fairly reasonable conjecture. (1.) Beaumont alone: *Woman-Hater; Triumphs of Honor and Love,* from *Four Plays in One; Inner Temple Masque.* (2.) Fletcher alone: *Faithful Shepherdess; Triumphs of Death and Time,* from *Four Plays in One; Wit without Money; Bonduca; Valentinian; Loyal Subject; Mad Lover; Humorous Lieutenant; Woman Pleased; Island Princess; Pilgrim; Wild Goose Chase; Monsieur Thomas; Woman's Prize; Wife for a Month; Rule a Wife and Have a Wife; Chances.* (3.) Fletcher and Beaumont: *Philaster; Scornful Lady; Maid's Tragedy; A King and No King; Knight of the Burning Pestle.* (4.) Fletcher, Beaumont, and probably Massinger or another: *Coxcomb; Cupid's Revenge.* (5.) Fletcher and either Beaumont or another, probably Massinger: *Captain; Honest Man's Fortune; Knight of Malta; Love's Cure; Thierry and Theodoret; Wit at Several Weapons; Love's Pilgrimage.* (6.) Fletcher and another, generally Massinger, sometimes Jonson, Middleton, Rowley, Shirley, Cartwright: *Queen of Corinth; Double Marriage; Sir John van Olden Barnaveldt; False One; Little French Lawyer; Custom of the Country; Laws of Candy; Spanish Curate; Beggar's Bush; Prophetess; Sea Voyage; Maid in the Mill; Lover's Progress; Nice Valor; Bloody Brother; Elder Brother; Fair Maid of the Inn; Noble Gentleman; Night-Walker.* (7.) Fletcher, probably Shakespeare, possibly Massinger: *Henry VIII.; Two Noble Kinsmen.* (8.) Wholly doubtful: *Faithful Friends.* Collected editions: first folio (1647); second folio (1679), ed. Tonson (1711); Theobald, Seward, Sympson (1750); Colman (1778, 1811); Weber (1812); Darley (1839); Dyce (1843–6); new ed. by A. H. Bullen and others (1904). Selections: J. S. L. Strachey (2 vols. 1887, Mermaid Series). Single plays: *Faithful Shepherdess* (ed. F. W. Moosman, 1897); *Knight of the Burning Pestle* (ed. F. W. Moosman, 1898); *Two Noble Kinsmen* (ed. C. H. Herford, 1897)—all in Temple Dramatists, Monographs: *Francis Beaumont,* by G. C. Macaulay (1883); A. C. Swinburne in *Studies in Prose and Poetry* (1894); A. H. Bullen, *s.v.* Fletcher in *D.N.B.* (1889); F. G. Fleay, R. Boyle, E. H. Oliphant, in various papers in *New Shakespeare Society's Transactions* and *Englische Studien;* F. G. Fleay's *Chronicle of the English Drama* (1891); A. W. Ward's *Hist. of English Drama* (2d ed. 1899); E. Köppel's *Quellenstudien zu den Dramen Jonson's, Marston's, und Beaumont's und Fletcher's* (1895); A. H. Thorndike's *Influence of Beaumont and Fletcher on Shakspere* (1901). See A. C. Potter in *Harvard Univ. Bibl. Contributions* (1890).

Fletcher, JULIA CONSTANCE (1858–), American novelist and dramatist, her pen-name being George Fleming, daughter of the Rev. James C. Fletcher. She was born in Rio Janeiro, Brazil, her father being a missionary at that place, and she subsequently lived in Italy and in London. She has written *Kismet* (1877), *Mirage* (1878), *The Head of Medusa* (1880), *Vestigia* (1882), *Andromeda* (1885), *The Truth about Clement Kerr* (1889), and *Little Stories about Women* (1897). Among her plays are *Mrs. Lessingham,* produced at the Garrick, London, in 1894, *A Man and his Wife* (Empire, New York), in 1897; *The Canary* (Royalty), in 1899; *The Fantasticks* (Royalty), in 1900; *The Light that Failed* (Lyric and New Theatre), in 1902.

Fletcher, ROBERT (1823–1912), American anthropologist, born in Bristol, England, graduated at the Royal College of Surgeons of England in 1844. In the Civil War he was a surgeon in the First Ohio Volunteer Infantry. Afterwards he became principal assistant librarian of the Surgeon-General's office, U. S. Army, Washington, D. C. He was professor of medical jurisprudence in Columbian University, president of the Anthropological Society of Washington, and editor of *Index Medicus.* He published *Human Proportion in Art and Anthropometry* (1883); *The New School of Criminal Anthropology* (1891); *Scopelism* (1897).

Fletcher, PHINEAS (1582–1650), English poet, brother of Giles Fletcher, was born at Cranbrook, Kent. His pastoral drama, *Sicelides,* was written for performance before James I. in 1614. Probably his other verse, all of which is Spenserian in manner, is also of early date. In 1616 he left Cambridge owing to a dispute; and in 1621 settled as vicar at Hilgay, Norfolk. Poems *Brittain's Ida,* ascribed to him (1627); *Sicelides* (1631); *The Purple Island and Piscatory Eclogues* (1633); *Collected Poems* (ed. A. B. Grosart, 1876).



Fleur-de-lis.

Fleur-de-lis, in heraldry, a conventionalized lily, or, as some think, iris. It is most famous as

the emblem of the kings of France, who bore a blue shield, powdered (semée) with golden fleurs-de-lis. Charles VI reduced the number to three, at which it has since remained. The fleurs-de-lis occur frequently in British heraldry. See HERALDRY.

Fleurus, flē'rus', market town, Belgium, province Hainaut, on the Sambre; 15 miles west of Namur. Here, on Aug. 29, 1622, the Spaniards were defeated by Duke Christian of Brunswick; on June 30, 1690, the Dutch and the Germans under Prince Waldeck were defeated by the French under Luxembourg; on June 26, 1794, the French under Jourdan gained a victory over the Austrians under the Prince of Saxe-Coburg. It has coal mines. Pop. about 7,000.

Fleury, flēr'i, FLORY, or FLOWERY, in heraldry (q. v.), signifies that the object thus described is adorned with fleur-de-lis.

Fleury, flē'rē', ANDRÉ HERCULE DE (1653–1743), French statesman and cardinal, was born in Lodève, in Languedoc. In 1715 he was appointed tutor to Louis XV, and acquired an influence over the King's mind which was always powerful. Upon the death of the regent he was made cardinal and in this position held the reins of French affairs. For seventeen years he gave France an orderly and peaceful rule, allowing the country to recover from the extravagances of Louis XIV, and putting forth every effort for peace and a good understanding with England. In 1733, however, he was forced, much against his will, into the War of the Polish Succession, which resulted in the addition of Lorraine to France. He was successful, in 1739, in arranging the Treaty of Belgrade between Austria and Turkey; but he allowed France to take a leading part in the War of the Austrian Succession (1741–8), instead of concentrating his energies upon the coming colonial and maritime war with England. Fleury was an Academician, and a friend and patron of learning. Consult Verlacque, *Histoire du Cardinal Fleury* (1879); P. Vaucher, *Robert Walpole, et la politique de Fleury* (1924).

Fleury, CLAUDE (1640–1723), French ecclesiastical historian, was born in Paris. Shortly after the death of Mazarin (q. v.) he was entrusted by Louis XIV with the education of the Prince of Conti, the Count of Vermandois, and later with that of the Dukes of Burgundy, Anjou, and Berri (1689). From 1684 to 1706 he held the abbey of Loc-Dieu, and then received the priory of Argenteuil in the diocese of Paris. In 1691 he began his great work, the *Histoire Ecclésiastique,* on which he labored for the rest of his life. It was published in 20 vols., between 1691 and 1720, and was continued by C. Fabre (1726–40), and A. Lacroix (1776–87). It is marked by great learning, and by a judiciously critical spirit. Fleury was elected to fill La Bruyère's place in the Academy in 1696.

Fleury, FRANÇOIS LOUIS TEISSEIDRE, MARQUIS DE (1749–94), French soldier who served in the American Revolution, was born in Languedoc. He joined the American forces in 1776, becoming a captain of engineers in May, and lieutenant-colonel in November, 1777. He took part in the Battles of Brandywine and Germantown; was engineer-in-chief at Fort Mifflin, where he was wounded; and was second in command of a corps of picked men at Monmouth. He received a Congressional medal for gallantry at Stony Point, and took part in the siege and capture of Yorktown. After the war he returned to France, served in Pondicherry, and became *maréchal de camp* in the French army.

Fleury-Husson, JULES. See CHAMPFLEURY.

Flex'ile Collo'dion, a composition made by adding two parts of Canada balsam and one of castor oil to forty-eight of collodion (see COLLODION). Painted upon the skin, it dries by evaporation, and forms an adhesive, transparent covering, which protects from air, dirt, and moisture.

Flex'ner, ABRAHAM (1866–), American educator, brother of Simon Flexner (q. v.), was born in Louisville, Ky. He was graduated from Johns Hopkins University in 1886, and later studied at Harvard (A.M. 1906) and the University of Berlin. He taught for many years; was associated as expert with the Carnegie Foundation for the Advancement of Teaching, New York, 1908–1912; secretary of the General Education Board, 1917–25; director of the Institute for Advanced Study in 1930. His published works include: *A Modern College* (1923); *Do Americans Really Value Education?* (1927); *Universities—American, English, German* (1930).

Flexner, SIMON (1863–), American pathologist, brother of Abraham Flexner (q. v.), was born in Louisville, Ky. He was graduated from the University of Louisville (M.D. 1889), studied at Johns Hopkins and the Universities of Strasbourg and Berlin, and was successively associate professor of pathology and professor of pathological anatomy at Johns Hopkins University (1895–9); professor of pathology at the University of Pennsylvania (1899–1903); pathologist at the University and Philadelphia Hospitals (1900–03); director of the Ayer Clinical Laboratory, Pennsylvania Hospital (1901); and director of the laboratories of the Rockefeller Institute for Medical Research, New York (since 1903). He discovered an anti-meningitic serum for the treatment of spinal meningitis (q. v.), and did valuable work in tropical dysentery, bubonic plague, and snake venom. In 1913 he announced the discovery of the ultra-microscopic organism causing infantile paralysis (q. v.). He received honorary degrees from several American universities, and was made a Chevalier of the Legion of Honor. He has published numerous papers and monographs relating to bacterial and pathological subjects including: *The Pathology of Toxalbumin Intoxication; Epidemic Encephalitis.*

Flex'ure, a term used in building to denote the bending of loaded beams. See ELASTICITY; STRENGTH OF MATERIALS.

Flicker, the popular name of a large group of birds of the woodpecker family, found throughout North and South America and in Cuba. See WOODPECKER.

Fliedner, THEODOR (1800–64), German philanthropist, was born in Epstein. He became pastor of a small Protestant colony in Kaiserswerth in 1821, and in 1823 traveled in Holland and England, where he made a special study of charitable institutions. In 1833 he opened in Kaiserswerth a refuge for discharged female convicts; two years later he established an infant school in Düsseldorf, and in 1836 founded at Kaiserswerth the first German Protestant institute for the instruction of deaconesses, an event which marked the beginning of modern nurses' training (see NURSING).

Flies, an order of insects, the general characters of which are discussed under the heading DIPTERA. See also BLUE-BOTTLE; BOT-FLY; GADFLY; GNAT; HESSIAN FLY; HOUSE FLY; MIDGE; MOSQUITO; ROBBER FLIES; etc.

Flight, in animals. See FLYING ANIMALS; BIRDS.

Flight, Mechanical. See AERONAUTICS; FLYING MACHINES; GLIDERS.

Flin'ders, flin'derz, MATTHEW (1774–1814), English hydrographer and discoverer, was born in Donington, Lincolnshire. He served on the *Bellerophon* at the battle of June 1, 1794, and in the following year went in the *Reliance* to New South Wales, where

he did valuable surveying, especially in association with George Bass. He is credited with having first suggested the name Australia for the island continent. In 1801, in the *Investigator,* he circumnavigated Australia, and charted the Gulf of Carpentaria. On his way home in 1803 he was wrecked on Wreck Reef, about 800 miles from Port Jackson. Reaching Mauritius, he was seized by the French governor and held a prisoner until 1810. He spent the rest of his life in preparing his monumental *Voyage to Terra Australis* (1814).

Flindersia, flin-dûr'si-*a,* a genus of tropical and sub-tropical evergreen trees found chiefly in Australia. They are tall trees of rapid growth and some species are of commercial value on account of the hardness and close texture of their woods. *F. Australis* and *F. Oxleyana* are used in cabinet work and for dyeing; *F. maculosa,* the Leopard Wood, yields timber for shingles and a mucilaginous gum.

Flinders Land, the early name of South Australia.

Flinders Petrie. See PETRIE.

Flint, a variety of quartz, occurring primarily in irregular, nodular, concretionary masses scattered through white chalk formations. The flints, when broken open, may show silicified shells of various fossils; and there is much evidence to establish the fact that the material has been deposited from solution, and has replaced the calcareous matter of the chalk and of the shells of Echinodermata, Mollusca, and Foraminifera which the chalk contained. The source of the silica must be looked for in the spicules of sponges and siliceous shells of Radiolaria which were scattered through the soft calcareous ooze that gathered on the sea bottom to form the white chalk. The silica of which these siliceous skeletons consist has been dissolved away, and it is natural to suppose that it has again been deposited elsewhere as concretionary nodules of flint. The hard, flinty nodules of similar origin found in American limestones are known as chert and hornstone (qq. v.) rather than true flint.

Flint, when freshly broken, is dark gray, almost black, and is translucent only on the edges of thin splinters. It weathers slowly, with the formation of a white crust, part of the material being dissolved away, leaving a porous outer layer. In composition, it is practically pure silica (see SILICON).

Flint pebbles seem to be almost indestructible, and are in use as material for road mending, for laying walks, and for roughcast ornamental plastering of the fronts of houses. Flint is rarely employed as a building stone. At present the principal use is in the manufacture of fine earthenware. For this purpose it is first calcined, then thrown into cold water, and afterward powdered. In former times flint was used in the manufacture of gun flints, and for making fire when struck with a piece of steel. In prehistoric times it was the rough material universally adopted for stone weapons, where it could be obtained. See FLINT IMPLEMENTS.

Flint, city, Michigan, county seat of Genesee county, on the Flint River, the Pere Marquette and the Grand Trunk Railroads; 61 miles N.W. of Detroit. It is the seat of the State School for the Deaf, and has 39 parks, covering over 1,140 acres.

Flint is one of the foremost automobile cities of the world, surpassed only by its sister city, Detroit, and the second largest manufacturing city in the State. The principal manufactured products include automobiles, spark plugs, carburetors, and other motor accessories, screw machinery, printing products, tile, flour, dairy products, and electric power, gas, coke and by products.

In 1819 Jacob Smith, a fur trader from Detroit, established a trading post here, at 'the grand traverse of Flint'; and in 1830 John Todd, a Pontiac storekeeper, bought 785 acres of land for $800, settling here with his family. Flint was made the judicial seat of Genesee county in 1835, two years before Michigan became a State; and incorporated as a city in 1865. Since the creation of the Buick Motor Co. in 1904 it has increased its population more than 940 per cent. Pop. (1900) 13,103; (1920) 91,599; (1930) 156,492; (1940) 151,275.

Flint, town, Flintshire, Wales, on the Dee estuary; 13 miles northwest of Chester. The industries include smelting, chemical works, and paper mills. The castle of Edward I, now in ruins, was the scene of Richard II's betrayal to Bolingbroke (Aug. 19, 1399). Pop. (1931) 7,635.

Flint, AUSTIN (1812–86), American physician, was born in Petersham, Mass. He studied at Amherst, was graduated from the medical department of Harvard (1833), and in 1836 removed to Buffalo, N. Y. There he established the Buffalo *Medical Journal,* and was one of the founders of the Buffalo Medical College, in which he was professor of the theory and practice of medicine (1847–53), and later (1856–8) professor of clinical medicine. He was also professor of the theory and practice of medicine in the University of Louisville (1852–6), professor of clinical medicine in the New Orleans School of Medicine (1858–61), and professor of pathology and practical medicine in the Long Island College Hospital (1861–8). From 1861 until his death he was an attending physician at the Bellevue Hospital, New York City, and professor of the principles and practice of medicine in the Bellevue Medical College He was president of the N. Y. Academy of Medicine from 1872 to 1885. He published a number of important medical works.

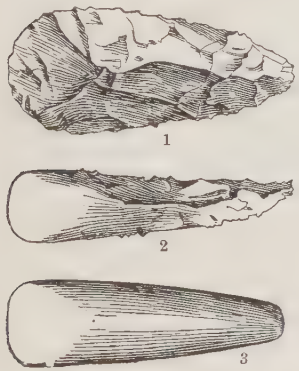
Flint, AUSTIN (1836–1915). American physician, son of Austin Flint (q. v.), was born in Northampton, Mass. He was graduated from Jefferson Medical College (1857), and began practice in Buffalo, N. Y., where he was professor of physiology at the University of Buffalo, and editor of the Buffalo *Medical Journal* (1857–60). He was professor of physiology in New York Medical College in 1859–60, and in the New Orleans Medical College in 1860–61. In 1862–5 he was acting assistant surgeon in the U. S. Army at the General Hospital, New York. He was one of the founders of the Bellevue Hospital Medical College, where he was professor of physiology from 1861 until 1898, when he became professor of physiology in Cornell University. In 1874–8 he was surgeon-general of New York State. He made important discoveries concerning the functions of the liver; and in his later years he was alienist for the State in many noted cases. He published a number of important works on physiology.

Flint, TIMOTHY (1780–1840), American clergyman and author, was born in North Reading, Mass., and was graduated from Harvard (1800). He was pastor of a Congregational church at Lunenberg, Mass., from 1802 to 1814, when, accused of being a counterfeiter on account of his scientific experiments, he prosecuted his accusers for slander, and shortly afterward resigned. From 1815 to 1825 he lived as a missionary and teacher in the Middle West, describing his experiences in his *Recollections* (1826). He edited the *Western Review* in Cincinnati in 1825–8, and in 1833 became editor of the *Knickerbocker Magazine,* New York. Among his works are: *Francis Berrian, or the Mexican Patriot* (1826); *Indian Wars in the West* (1833); *Memoir of Daniel Boone* (1834).

Flint Implements, tools fashioned by the hand of primitive

man. In Europe they are classified under two heads—(1) the palæolithic, and (2) the neolithic.

(1) Belonging to the first period are the implements found (*a*) in the river drift. The earliest discovery of such remote implements was made in 1847, by M. Boucher de Perthes, at Abbéville. Several other localities in Northern France, and also in Southern Europe, were brought to light; and the valley of the Ouse is considered the northern limit beyond which no true palæolithic implements have been found. In the sites named they are associated with such extinct animals as *Rhinoceros hemitœchus, Elephas antiquus, Felis spelæa.* The implements of the river drift are flakes, ridged, flat, or polygonal; trimmed flakes; pointed tools; and implements with sharp rims. In the second group of palæolithic implements are classed (*b*) those from the caves, the discoveries in which at Dordogne and in Belgium are associated with the names of MM. Tournal, De Christol, De Serres; and in England, at Kent's Cavern and Brixham Cave near Torquay, exploited by Pengelly, Buckland, Dawkins, and others. A remarkable so-called Hyæna Den was discovered at Wookey



Flint Implements
1. Rough. 2. Edge polished. 3. Polished.

Hole, in Somersetshire; and there are caves, productive of interesting results, in the county of Glamorgan. The principal tools found in use during this period are knives, axes, and scrapers, frequently in association with harpoons and other implements of bone.

(2) Neolithic flint implements comprise three varieties: (*a*) merely chipped specimens; (*b*) those ground at the edge only; and (*c*) specimens beautifully polished and shaped. Chisels and gouges are found, and in endless variety of size, form, and finish; saws, sometimes sickle-shaped: scrapers, used in dressing hides; borers and awls; trimmed flakes; knives and fabricators; arrowheads and spearheads. In Egypt, Flinders Petrie has found remarkably finished specimens, worked with the ripple-flaking supposed to be characteristic of the Danish flint daggers, under conditions that seem to warrant his consigning them to a period as early as the fourth dynasty.

Flint implements have been found in recent years on the Kent plateau and elsewhere which are referred to earlier geologic time than the Palæolithic age, and to which the general name *eoliths* has been given. Since 1909 large numbers of beak-shaped and other implements (including some generally similar to the so-called eoliths of Kent) have been discovered at the base of the Red Crag marine deposits of Suffolk. To these Sir Ray Lankester attributes great antiquity, placing them in the Pliocene, or possibly in the Upper Miocene Age.

Flint implements are abundant in South America, but seem to have been used in a period of polished stone tools. See AMERICAN ARCHÆOLOGY.

Consult Evans' *Ancient Stone Implements of Great Britain;* Wright's *Man and the Glacial Period.*

Flintlock. See GUNS.

Flintshire, maritime county of North Wales, the smallest in Wales, bounded N. by the Dee estuary and Irish Sea, N.E. by the Dee, E. by Cheshire, and S. and W. by Denbighshire. It has a length of 26 m. a breadth of from 6 to 13 m. and an area of 163,707 acres. It rises in the S.W. border range to 1,820 ft. (Moel Fammau). Dairy farming and sheep breeding are carried on. Coal is mined, and fire clay, lead and zinc are worked. Flint is the county town. Pop. (1931) 112,849.

Flitter-mouse, a common name for a species of bat. See BAT.

Floating Battery, an armored vessel carrying heavy guns, but with light draught and feeble motive power, or none at all; built to defend outlying channels, reduce otherwise inaccessible forts, cover landing operations, and other like purposes. At the siege of Gibraltar, in 1779–83, the French and Spaniards unsuccessfully used floating batteries, but in the Crimean War floating batteries (French) reduced Kinburn (1855), a Russian fort on the Dneiper which had been invested for months by the French and English navies. The American *Monitor* (q.v.) was a floating battery.

Floating Docks. See DOCKS.

Floating Islands, masses of vegetation which have been severed from the sides of a river or lake, or raised by gases from the bottom to the surface. They are not uncommon when rivers are in flood, and may so accumulate as to block the normal river course. In the Mississippi River they are often formidable. Floating islands are common in flat lands, where a river or lake is not confined in a well marked valley or hollow, and where its sides are bordered by reeds and grasses, which may form a complete covering over stagnant pools. From this reedy and grassy border or covering islands are floated off when the water rises, and these may gather to form a dam, as does the *sudd* of the White Nile. See MISSISSIPPI RIVER; SUDD.

Floatstone, a light, porous form of quartz, which sometimes will float on water. It is mostly white, and occurs in nodular or concretionary masses.

Flodden, Battle of (FLODDEN FIELD), a battle on Sept. 9, 1513, between James IV. of Scotland and an English army under the Earl of Surrey. James was strongly encamped on Flodden Hill, between Coldstream and Wooler, in Northumberland; but having permitted Surrey to cross the Till and cut off communication with Scotland, he was forced to attack. The Scottish left, under Huntly and Home, drove back the English right; but on the Scottish right Lennox and Argyll were routed by the opposing bowmen. Night closed upon the combat, and at dawn the Scots retreated, leaving from 6,000 to 10,000 dead and wounded. The English loss exceeded 4,000, and the dearly bought victory paralyzed Surrey's northern advance.

Flogging. See WHIPPING.

Floire et Blanchefleur, an early French romance, of which there exist two twelfth century editions. Indications are not lacking that it is of Byzantine origin. It contains the touching story of two children who love, are separated, but are eventually happily reunited after overcoming many difficulties. Another form of the story, much altered in transmission, is the better known *Aucassin et Nicolette.*

Flood, HENRY (1732–91), Irish political leader and orator, was born near Dublin. He entered the Irish Parliament in 1759—from the first making his mark as a ready and effective debater and a persuasive orator. Appointed vice treasurer of Ireland (1775), he was dismissed, after six years' tenure of office, because he was out of sympathy with government policy. He was thereafter elected M.P., first (1783) for Winchester, and later (1784) for Seaford, in the British House of Commons. He pub-

lished several poems and a volume of *Speeches* (1787).

Flood, The (Biblical). See Deluge.

Flood Plain. See Floods and Flood Control.

Floods and Flood Control. Floods are largely due to and caused by the rapid rising of rivers due to great rainfall, which causes an overflow of the banks, and the flooding of the adjacent country. Other floods are caused by earthquakes that generate tidal waves which flood nearby coasts. Storm tides are caused by cyclones and hurricanes, which pile the water up on adjacent shores to the extent of 10 to 40 feet. The gradual rising of lake levels causes the flooding of shore lands, and the giving way of ice dams, and of man-made dams of earth and masonry cause severe local floods. The river floods are greatest usually when a sudden thaw melts the snow and frozen waters near the sources, that meet floods caused by excessive rainfall farther down the stream. Cloud bursts also cause great local floods. Rainfall of from 4 to 21 inches in one night caused the highest flood in 70 years on the Republican River in Nebraska, Kansas and northeastern Colorado (1935). Deforestation has the effect of increasing floods after their initial periods, as the run off only becomes a maximum after the ground and green growths have become fully saturated. The same thing is true to a greater extent where forests are in existence.

Earthquake floods frequently cause great loss of life and property due to the forming of huge tidal waves that impinge upon the nearby lands, such as occurred in the year 684 in Japan when the Sikoki Islands were practically swallowed up. The greatest tidal wave was that at Lisbon, Portugal, which is recorded to have attained a height of 40 feet (Nov. 1, 1755). The great tidal waves caused by the eruption of Krakatoa have even obliterated the land, and the volcano now erupts beneath the water. The waves or storm tides caused by cyclones cause very great damage, like the Backergunge cyclone, which is reported to have caused a rise of 40 feet in the delta of the Ganges, and is also said to have caused a loss of 100,000 lives. A great disaster of this kind occurred in Holland in the year 1230, and a greater one in 1521, where the breakage of the dykes caused 100,000 people to perish. The great devastation at Galveston from the 1900 hurricane was followed by later ones, which even topped the newly-built sea wall, and made it necessary to build the concrete masonry higher. Every West Indian hurricane causes such damage, and in the great blow of 1915 when the wind velocity reached a maximum of 140 miles per hour below New Orleans, the storm tide rose to 9 feet at the entrance to Rigolets Pass to the east, and to 13 feet at the western end of Lake Pontchartrain to the north.

Floods due to the failure of great reservoir dams often cause immense damage to property, and loss of life like that at Johnstown, Pa. on June 1, 1889, where 2500 people perished; or that at Austin, Pa. on Sept. 30, 1911. The more recent failure of the St. Francis water supply dam at Los Angeles was of great magnitude, but owing to the sparsely settled country below, the damage of over $7,000,000 was not relatively great. Floods on the Indus River in India are caused quite often by the giving way of ice or glacier dams, and sometimes whole villages are destroyed. Additional causes of floods in India are due to the melting of snow, and rainfall during cyclones. Floods from dams formed by floating vegetation often occur on the Nile above the Sobat confluence; on the Congo River tributary Lualaba; and on Paraná River in South America.

The Yellow River in China is subject to great floods, many of them due to changes in the course of the channel. The mouth of this river has varied in location as much as 350 miles during historic times, and it is said that from 40 to 50 millions have lost their lives from 1851 to 1866. The flood protection by dams and levees in the Huai River Valley of China is estimated to cost $20,000,000. The sudden melting of snows, already mentioned, combined with large rainfall caused the great flood in France of 1658 on the river Somme, and also in 1740, 1795, 1814 and 1838. The same kind of a flood submerged much of Paris on the river Seine in 1910. The chinooks or warm winds in the Pacific northwest of the United States cause sudden floods to rush down from the Cascade Mountains almost over night.

The Flood Control problem is one which concerns practically every country in the world, and has become a major problem in the United States due to man-made aggravation of contributory causes. Referring to the Table in this article we find the great historic floods to have been most widely scattered over the surface of the globe. They emphasize the wide-spread world need for proper flood control, for most of these disasters can be prevented in our present state of knowledge, by proper flood control works.

The long study of protection is shown by the 200 years spent on planning for protection at Leningrad. The long study of the flood conditions of Leningrad has been intensified since the flood of Sept. 23, 1924, which covered nearly all of the 50 square miles of the city to a depth of from five to seven feet, and caused great suffering and disaster to the 1,000,000 inhabitants. Since that time projects have been studied for dams across Neva Bay at various points to shut off these tidal floods, but as a rule sea walls such as that at Galveston are more effective.

Over 125 years' study and experimenting have been expended on the Mississippi. The first record of a Mississippi River flood is that reported by Vega in 'La Florida del Inca,' an account of the De Soto expedition from Florida westward, in March and April, 1543, taking 40 days to reach its crest. As this was before any of the forests in the Mississippi basin had been razed by the white man, it is regarded as evidence in a general way that the floods of recent years have not been due to deforestation.

The first extended report on the Mississippi and Ohio Rivers was made in 1824 by Gen. Simon Bernard, who was one of Napoleon's Aides at the battle of Waterloo. He came to America in 1816 and remained until 1830 as titular head of the Corps of Engineers of the United States Army. (See *The Mississippi Flood Control Problem,* by Charles E. Fowler, 1927). At that early date there was not enough money available to even begin any adequate protective work, but the report formed a basis for future planning, as did the report of Charles Ellet, Jr. in 1851 in another study for the War Department. Then in 1861 the report was made by Capt. A. A. Humphries and Lt. H. L. Abbott of the Corps of Topographical Engineers, entitled 'Report on the Physics and Hydraulics of the Mississippi River; Upon the Protection of the Alluvial Region Against Overflow; and Upon Deepening the Mouths; based on Surveys and Investigations.' This great volume of 600 pages is still the most monumental work on the subject ever produced.

The many pages of the Report that lists the books on hydraulics, and the names of the engineers and scientists who have contributed in one way or another to the cure of floods, only goes to show the great importance of the subject. Those dealing with

LOUISVILLE, KENTUCKY, DURING THE GREAT FLOOD OF THE OHIO RIVER, JANUARY, 1937

WPA WORKERS CLEANING UP SANDBAGS USED FOR DIKES

CARROLLTON, KENTUCKY, ON JANUARY 29, 1937 DURING THE RECORD FLOOD

All photos on this page Courtesy of the Works Progress Administration

Floods and Flood Control

the Flood Control problem have failed to observe many other limiting conditions of this 'Mississippi Bible.' Gradually the solution of the problem has been forced by a great array of factual data.

The enormity of the problem for the control of the Mississippi River may be better comprehended by considering that from 53 to 97 per cent of all the farm and industrial production of the United States, in various lines, comes from the Mississippi Basin. The flood of 1912 carried 2,000,000 second feet of water past Cairo, Illinois, or 3,750,000 tons of water per minute. The 1927 flood greatly exceeded this and the yearly damage is in excess of $50,000,000; and one cubic mile of silt, it is estimated, is carried down to the Gulf each year.

The various factors for the control of such huge natural destructive forces are, in the order of their importance: (1) Levees of earth and of masonry. (2) Dredging for deepening and rectification. (3) Detention dams on source streams to hold back flood waters. (4) Spillways at various points to divert part of flood waters. (5) Reforestation of cut off timber lands and extension of forest areas. (6) Contour farming.

Levees are the first remedy thought of and the first to be used, having been employed in all historic times. The dykes along the River Po in Italy were largely constructed by Napoleon over a hundred years ago, but they have resulted in raising the elevation of the bed of the river, and the dykes together with various improvements on the surrounding land, such as cutting off the forests, and extensive farm drainage, has resulted in raising the flood level seven feet during less than 200 years. The same thing has occurred on the Yellow River in China; in Japan as well; and on large sections of the Mississippi River. Many of the earlier levees were of too slight cross section or thickness, so that they failed when most needed. The new levees on the Mississippi are much thicker, with the river slopes protected by fascines or paving, so that they afford protection during the highest floods.

Dredging on many reaches of the river is being resorted to, and also many S curves are being eliminated, so that the velocity of the current is being increased to carry away the flood waters and silt much more quickly. This is all right to a limited extent, but if carried too far on the upper river the flood waters will pile up on the lower reaches of the river, and sweep everything away. An exaggerated instance occurred in the improvement of the Puyallup River near Tacoma, Washington, where all the bends were dredged out and the river made absolutely straight from the Cascade Mountains to tide water on Puget Sound, so that with the smoother banks and greater slope, the storm waters rushed down upon and overwhelmed the lands and mills near the mouth of the river. In another case, on the other hand, where the lower Skagit River had only one bank at the 18 feet high tide level in Puget Sound, the creation of a west bank with piles, brush, and rock for a distance of four miles up from the mouth, caused the river to scour out and release the flood waters quickly into the Sound, thus proving very beneficial in stopping damage.

Detention Dams are the most basic and the best real cure for floods, and if numerous enough will practically stop floods for all time. The five great tributaries of the Mississippi will all in time be provided with such dams at the head waters of their own tributaries. They are the Missouri, with over 30 tributaries, the Arkansas, the White and the Red Rivers from the West, and the Ohio from the East. The Ohio has 13 principal source streams, the Allegheny, Monongahela, Mahoning, Muskingum, Scioto, Miami, Little Miami, Kanawha, Little Kanawha, Big Sandy, Wabash, Tennessee, and the Cumberland. The dams on the Miami, five in number, have been completed by the Miami Conservancy District at a cost of about $34,000,000 and have proven to be absolutely efficacious, together with some dredging of the river channel.

The act creating the District was passed by the Ohio Legislature in 1914 and the engineering work was placed in charge of Arthur E. Morgan, of the Morgan Engineering Company of Memphis. Five dams were built, at Germantown, Englewood, Taylorsville, Hoffman, and at Lockington. The work covered about 19,000,000 cubic yards of earth and rock, 250,000 cubic yards of concrete, and the rebuilding of 55 miles of railway. The real test of the project came in 1922 when there was a general heavy rainfall for three days all over the District. Under former conditions at Dayton, the 18 feet danger mark on the flood gage would have been exceeded, but with the dams the maximum was only 9.6 feet. About half the reduction was due to the dams, and one half to the deeper and larger river channel. Only 32 per cent of the channel capacity at Dayton was used, and only 4 per cent of the capacity of the reservoirs. After the stage reached, the rise in the river would have been slower, as the basins were just beginning to store any large amount of water, so that the system thoroughly proved itself.

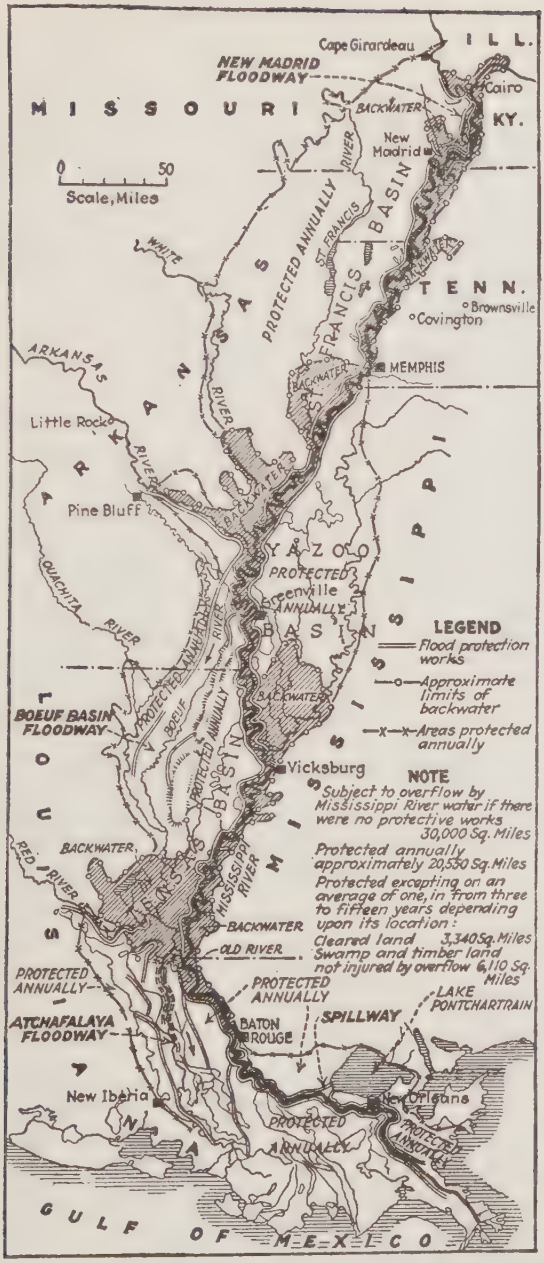
These dams are earth fill structures of safe cross section, and the outlets from the dams to let out the flood waters slowly, are provided with 'hydraulic jumps' to kill the velocity, so that the flow into the river is comparatively quiet. The five dams will hold 847,000 acre feet of water, or 40 per cent more than the greatest recorded flood. The dams on the Muskingum River emptying into the Ohio at Marietta are 15 in number.

The Muskingum dams are spread over the drainage basins of the main river, the main tributaries, the Tuscarawas River, and the Walhonding River, together with the lesser streams as far north as Akron. The storage capacity for the 15 reservoirs is probably about 40 per cent more than for the Dayton project, and an alternate study of 50 smaller reservoirs costing the same as the 15 adopted, showed a storage capacity of about 1,100,000 acre feet, of which 70 per cent was for flood control, and 30 per cent for water conservation. When this system and that of the Scioto River are completed, the floods of Ohio that contribute to the Ohio and Mississippi River deluges will be practically all under control.

There have been planned 43 flood dams for the Allegheny and Monongahela Rivers which come together at Pittsburgh to form the Ohio. There are 17 of these dams which are of sufficient capacity to call for immediate completion at a cost of $34,000,000. These dams would have a capacity of about 60 billion cubic feet of water storage, in a drainage area of 10,182 square miles, or about 70 per cent of the Allegheny basin, and about 30 per cent of the Monongahela basin. The resulting flood reduction at Pittsburgh would be 8 feet for the 1907 flood; over 18 feet for the 1900 flood, and an average of 12 feet for the eleven great floods considered in the Report of the Flood Commission.

The great reduction in the flood stage at Pittsburgh would probably make any further flood protection unnecessary, but a concrete levee wall around the city water front has been considered, and would be high enough to shut out the floods.

Floods and Flood Control



Main Features of Proposed Flood Protection System

Hatched areas indicate submergence from backwater at lower ends of flood basins in occasional years; dash line shows boundary of protected area. Note river bank flood channel from Cairo to New Madrid, wide floodway west of the river in the Tensas basin, and Atchafalaya floodway. Just above New Orleans a spillway into Lake Pontchartrain is also proposed.

(Redrawn for *Engineering News-Record* from map with report of Major-General Edgar Jadwin, Chief of Engineers, U. S. A.)

The concrete levee wall at Portsmouth, Ohio, built some years before, had kept out the floods until that of 1936, which caused the wall to be topped by two feet of sand bags. This represents an increase of about 5 per cent in the flood level, due partly to the same causes as mentioned for the River Po — — deforestation and land drainage. This was augmented by the silting up of the channel back of the numerous Chanoine navigation dams, and to an unknown extent to the increase in the area over which rain fell simultaneously, in all of the Ohio River drainage basin. The great extent of the Mississippi basin, from the Allegheny to the Rocky Mountains, and from Canada to the Gulf of Mexico, makes the question of simultaneous rainfall over a great part of the basin, an important factor in the Mississippi flood problem, as it is in other large drainage basins elsewhere in the world.

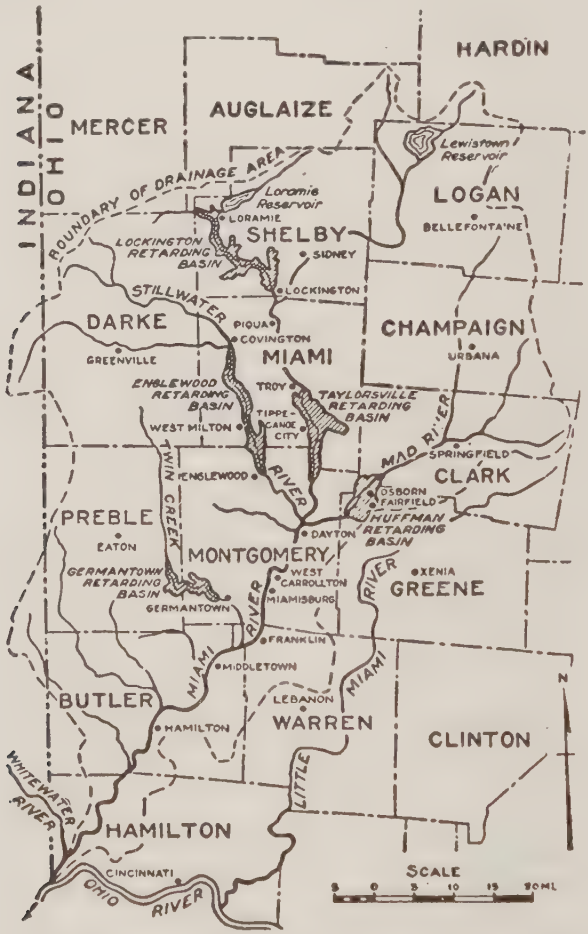
The systems that must be created in New England, in southern California and other parts of the United States, are important locally, but the great Boulder Dam on the Colorado River below the Grand Canyon, has created a system second only to that of the Mississippi, as affecting the welfare of a large number of the western States, but most particularly Arizona and southern California. The dam rises to a height of 730 feet, creates a lake 115 miles long, with a storage capacity of about 30,000,000 acre feet, and produces from 500,000 to 1,000,000 H.P. of electric power. This electric power began to be delivered to Los Angeles in 1936, and when the All American canal is completed, water will also be taken that far to the west, and will also be delivered over a great area in between, and over a large area of Arizona. While the flood problem was of considerable importance, with the dam completed that phase entirely disappears, and the project becomes one of power distribution, and of large scale irrigation over a great and new section of the far southwest.

The drainage basin of the Mississippi River covers an area of 1,240,000 square miles or over one third of the total area of the United States. The average annual precipitation is 29.8 inches, of which one fourth goes to the Gulf of Mexico. The total flood discharge is 785,190,000,000 cubic yards, and the silt carried amounts to 406,250,000 tons.

The San Gabriel dam for flood control in southern California was completed in 1937 at a cost of more than $250,000,000. With a height of 300 feet and a length of 1670 feet it will provide a reservoir of 62,000 acre feet in San Gabriel Canyon. This would be about 30,000,000 acre feet for flood control, 27,000 for water conservation, and 5,000 for debris space.

The dams on the Tennessee River built or under construc-

tion, under Arthur E. Morgan, Director, are in the order of their location from the mouth, the Pickwick, Muscle Shoals, Wheeler, Guntersville, Chicamauga, Hiwassee and Norris. There is one planned above Paducah, one on the Little Tennessee, 380 feet high, and also other important ones under consideration.



MAP OF MIAMI RIVER–DRAINAGE AREA, SHOWING DETENTION BASINS FOR FLOOD CONTROL

The Tennessee River is 652 miles long, but from its real source at the head waters of the North Fork of the Holston River its total length is 900 miles. The Norris Dam is 30 miles above Knoxville on the Clinch River, where the maximum flow is 60,000 second feet, occurring about every 17 years. There is a probability that this has reached 70,000 second feet in modern times. The Norris Dam has a height of 240 feet, a length of 1,570 feet, to store 3,000,000 acre feet of water and generate 100,000 kilowatts of electric power. This power production requires 1,500,000 acre feet annually, leaving 1,200,000 acre feet for flood control, and 400,000 acre feet for extraordinary flood control, thus leaving 500,000 acre feet of dead storage. The annual silt load is 1,030 acre feet, so that the dead storage space would not be filled for about 500 years. The Wheeler dam has a length of 6400 feet, and a height of 70 feet, to form a lake near Guntersville, Alabama, 80 miles in length, to develop 280,000 H.P. of electric power. These two dams in connection with the great Muscle Shoals dam, and the proposed dam above Paducah, do not by any means exhaust the flood control possibilities on the Tennessee River, and there is possible a ship canal to the Gulf of Mexico, and other large and vital improvements that can be made.

All told the more than 100 dams at the sources of the Ohio, and a large one above Paducah on the Tennessee, will practically cure the floods on this stream, be a great aid to river transportation, and reduce the flood waters reaching the Mississippi by at least 20 per cent. The dams on the western tributaries of the Mississippi would take care of about double this amount, or leave less than 25 per cent for the main river to carry, by assuming that reforestation and contour farming would care for 10 and 5 per cent respectively.

Spillways have been a cause of contention for a century, and in the 1851 report of Charles Ellet, Jr., he recommended a spillway into Lake Borgne below New Orleans to carry 210,000 second feet of water. Of the spillway through Lake Pontchartrain to carry 250,000 second feet, he found more in its condemnation than in its favor. He recommended among others the enlargement of the Bayou Plaquemine, and the use of the Atchafalaya channel, which is still the most vital.

The Atchafalaya River would be bounded by back levees. The existing levees would be retained so as to confine the flood waters to the river proper up to the 1927 flood stage. The head of this floodway would be closed by 'safety plug' or 'fuse plug' levees, with heights so adjusted that they would be overtopped at the 1927 level and then blow out, releasing the water to the larger area bounded by the back levees. This channel alone, if used as a flood outlet to its full capacity, would insure the safety of New Orleans, and the lower river country.

The Missouri River detention dams will be a very large problem to work out, as there are more than 30 large tributaries in the 2560 miles length of this great stream. The length from the source to the Gulf of Mexico is 4200 miles, or assuming this to be the real Mississippi River, the longest stream in the world. The three source streams that form the Missouri are the Jefferson, Madison and Gallatin. The reservoir capacities of the principal detention dams would be about 30,000,000 acre feet, or about the same as for the Boulder Dam lake. The Arkansas and White River dams would hold back about 14,000,000 acre feet, and the Red River about 6,000,000 acre feet. The grand total for the entire basin to the west would thus exceed 50,000,000

FILLING SAND-BAGS TO BE USED IN BUILDING TEMPORARY LEVEES AGAINST THE FLOOD AT MEMPHIS, TENNESSEE, IN JANUARY, 1937

Courtesy of the Works Progress Administration

COAST GUARD BOATS RESCUING FLOOD VICTIMS AT EVANSVILLE, INDIANA

Courtesy of the American Red Cross

THE BEGINNING OF A SERIES OF DAMS AT GENOA, WISCONSIN, CONSTRUCTED TO CONTROL FLOODS

Courtesy of the Works Progress Administration

Floods and Flood Control

acre feet. The aid the dams would give to irrigation, navigation and power production would warrant their construction, regardless of the need for them for the final solution of the flood problem.

The excess waters of the Red River can be carried down across southwestern Louisiana for navigation, power and rice irrigation.

The Great Floods of History

Date.	Place.	Damage.
322 B.C.	Ephesus, Asia Minor	City destroyed.
241 B.C.	Rome, Italy	Lower part of city destroyed.
48 A.D.	Thames Valley	10,000 lives lost.
684	Sikokf Island, Japan	500,000 lives lost.
738 or 758	Glasgow	400 families lost.
1208	France	Said to be the greatest in the history of France.
1219	Norway (St. Lawrence Lake)	36,000 lives lost.
1228	Friesland	Irruption of sea drowned 100,000 people.
1421 or 1446	Holland	72 villages and 100,000 lives lost.
1521	Holland	100,000 lives lost.
1617	Catalonia	50,000 lives lost.
1642	Kaifong, China	300,000 lives lost.
1646	Holland	110,000 lives lost.
1722	Yorkshire	
1787–8	India	15,000 people and 100,000 cattle lost.
1824	St. Petersburg (Neva River)	10,000 lives lost.
1829	Scotland (Moray Floods)	
1830	Vienna (Danube River)	
1846	France (Central and Western)	$20,000,000.
1849	New Orleans, La	1,600 lives lost.
1856	France (Southern)	$28,000,000.
1874	Mississippi Valley	1,338 square miles inundated.
1875	France	$60,000,000.
1876	Bengal, India	200,000 lives lost through storm wave.
1889	Johnstown, Pa	2,500 lives lost.
1897	Mississippi Valley	20,000 square miles inundated.
1905	Guanajuato, Mexico	1,000 lives lost.
1907–8	Pittsburgh, Pa	$6,514,000.
1910	Paris	$200,000,000.
1911	Austin, Pa	76 lives lost.
1912	Mississippi Valley.	
1913	Ohio Valley	$180,800,000.
1914	China; West River Valley	$43,000,000; 3,300 lives lost.
1915	Galveston, Tex.	300 lives lost.
1921	Pueblo, Col.	$20,000,000.
1927	Mississippi Valley	$225,000,000.
1927	New England, particularly Vermont	$50,000,000; over 100 lives lost.
1937	Ohio and Mississippi Rivers	Greatest flood in U. S. history; 11 states partially inundated.
1938	New England Coast	488 lives lost.
1939	Yellow River, China	25,000,000 rendered homeless

The problem then becomes one of stopping off the flood waters above as far as possible, and providing plenty of outlet and channels for carrying away the water that finally reaches the lower river.

Reforestation, it will be seen from the foregoing, is not of the great importance usually accorded to this sort of cure for floods. Should replanting of old and planting new forests cause a lessening of flood waters of 10 per cent, as has been considered, that would be a maximum to strive for, because after the first fall of rain the trees and undergrowth become saturated and the water then falling finds its way immediately into the streams to augment the floods. The second growth over logged off lands is almost as effective in limiting floods, as was the original forest.

Contour Farming has been practiced for thousands of years in China, and has long been used in the United States, notably in the Carolinas. Initially it prevents the washing away of the top soil, and holds the moisture in the soil to aid the growing crop. This also is of benefit to the cure of floods, as if it were generally practiced it would reduce flood waters generally by more than 5 per cent.

The Jadwin plan for the flood control of the Mississippi basin, or that one approved by Chief of Engineers, U.S.A. Major General Edgar Jadwin under date of December 1, 1927, and submitted to the Secretary of War, was the result of very extensive studies by a large number of the members of the Engineer Corps. This comprised a more extensive permanent levee system, numerous floodways and spillways, and channel stabilization. Including the maintenance of a navigation channel from Cairo to New Orleans, not less than 300 feet wide and nine feet in depth, at a cost of practically $300,000,000 with $6,000,000 annually for maintenance, or only 2 per cent per annum. No money to be expended in any State, until that State had agreed to furnish without cost to the Federal Government and when required, all new rights of way, and to assume all damages resulting from construction and maintenance, except for controlling or spillway projects. The cost to be divided between the Federal Government and the States in the ratio of 80 per cent and 20 per cent. The Federal Government to bear all costs of channel stabilization, or a net cost to the States of 16 per cent of the total. This plan was simply to amplify the old system of caring for the floods, and not do anything towards detention works. Besides strengthening the levees, there were to be provided four spillways or overflow floodways, one into Lake Pontchartrain of 250,000 second feet capacity; one between Cairo and New Madrid; one below the mouth of the Arkansas; and the one into the Atchafalaya as already described. This system is all shown on the map herewith of the Mississippi from Cairo to the Gulf.

All of this plan is based upon the 'maximum possible' flood as predicted by the United States Weather Bureau, and the 'maximum probable' flood assumed by the Mississippi River Commission, both of which have been founded upon comparatively meager data. The six major means for this have been listed and discussed, and their effective results demonstrated by projects already put into operation. However, it must be borne in mind that no half-way measure can be undertaken without the danger of disaster, and the possible loss of all expenditures made for a partial program. During the study of the necessary parts of a complete project, many minor cures will suggest themselves, and they should be added to the six major cures, as it can always be done at slight additional cost.

Usually the removal of islands, piers, and other obstructions will be quite as effective as the straightening of the channel. The removal of dams formed by detritus of various kinds is usually a continuing process, unless a permanent cure is worked out. The Puyallup River, as well as other similar streams, carries a large amount of drift logs and brush which, lodging in the river bends, form dams that block the free passage of flood waters and floods the adjacent lands. As most of this material originated near the source of the Puyallup, a dam was designed to catch this

drift, where it could later be piled up and burned. This consisted of a series of concrete piers across the stream, upon which were strung wire ropes to form a fence which, catching the drift, would let the waters through. When wire ropes broke they could cheaply be spliced or replaced. Natural forces are constantly causing changes, which must be watched and studied as to means to cope with them. Where curative works are not carried out, or channels dredged, the river spreads out across thousands of acres or square miles of land along the banks and deposits the silt to form a flood plain.

The Mississippi Flood Plain is an immense tract, where for over 200 miles the material of the valley is entirely of river origin, and maps of the lower river indicate that the highest and driest land is largely along the river banks. The flood period is usually from January to April, so it is not always possible to farm this silt enriched soil, as is done on the River Nile, where the flood season occurs from the last of June to October.

When detention dams are used, it must be borne in mind that the holding back of the flood waters must be only temporary, and the outlets large enough to largely free the reservoirs of water in time for the next flood, and yet not let the water out into the stream below so rapidly as to cause damage. Thus to make possible the early emptying of the Dayton reservoirs, the river channel below the dams was enlarged. This early emptying of the reservoirs makes it impossible to use the water for the creating of an all the year round supply of electricity up to any great output of power. The same reason causes a limit to the aid of navigation that can be afforded by the use of water from detention dams.

The most disastrous floods in the nation's history occurred in January, 1937, when the Ohio and Mississippi Rivers overwhelmed great portions of eleven States: Pennsylvania, West Virginia, Kentucky, Ohio, Indiana, Illinois, Missouri, Tennessee, Arkansas, Mississippi and Louisiana. A million were left homeless. To cope with the situation a deficiency appropriation measure was hurried through the House and Senate, of about $789,000,000. A Disaster Loan Corporation was created with $20,000,000 to lend to flood victims.

See DAMS; DIKES; RETAINING WALLS.

CHARLES EVAN FOWLER,
Consulting Engineer.

Floorcloth. See LINOLEUM.

Floors. See BUILDING.

Floquet, flō-kā', CHARLES THOMAS (1828–96), French statesman, was born in St. Jean-Pied-de-Port (Basses-Pyrénées). He was educated for the bar and was a bitter opponent of the Second Empire. He was a member of the government of Paris during the Commune, and was imprisoned on a charge of having favored the Communists (1871). Appointed editor of the *République Française,* he was also elected to the Chamber of Deputies (1876), where he strongly opposed the reactionary designs of the time. He then became president of the Chamber (1885), and eventually formed a ministry (1888). Always an ardent republican, he challenged General Boulanger, and wounded him in the duel that followed. Defeated on the question of revision of the Senate, Floquet resigned (1889); but in the same year again became president of the Chamber. His connection with the Panama case compelled him to retire to private life for a time.

Flor, ROGER DI (fl. 13th–14th centuries), an Italian adventurer and soldier of fortune. Of humble origin, he served as a boy on a galley owned by the Knights Templars. He became a member of that order and was placed in command of a galley. Denounced as an apostate and thief, he was stripped of his rank. He next adopted piracy as a profession, then became a naval commander under king Frederick of Sicily. The latter, desiring to rid himself of his Catalan mercenaries, passed them to Flor, who led them against the Turks. He entered the service of the emperor Andronicus II, was made a duke and married into the imperial family. He was assassinated at the instigation of the emperor Michael Palaeogus at Adrianople.

Flora, the ancient Roman goddess of flowers, whose festival was held annually in the spring from April 28 to May 3. In 238 B.C. a temple was erected to her in the Circus Maximus in Rome.

Flora, a term used to indicate the totality of plant species in a circumscribed area. It may also serve to indicate the totality of plant species at a given epoch in time, so that we speak of the Miocene flora. See BOTANY; PLANTS.

Flora, city, Illinois, Clay county, on the Baltimore and Ohio Railroad; 100 miles southeast of Springfield. It is situated in a fruit-growing district, and has shoe and garment factories, dairies, ice plant, and cold storage plant. Pop. (1920) 3,558, (1930) 4,393.

Florala, city, Alabama, in Covington county, on the Central of Georgia, and the Louisville and Nashville Railroads; 97 miles south of Montgomery, near the Florida border. It was incorporated in 1901. Pop. (1930) 2,580.

Flore and Blanchefleur, a medieval romance, resembling that of *Aucassin and Nicolete.* It is found in most European languages, but the setting is Oriental. The love story of two children, it has been rendered in metrical form both in French and English. A copious literature has grown up around the romance.

Florence, province, Central Italy, embraces the central portion of the basin of the Arno, and extends into the Apennines on the north; area, 1,497 square miles. A pleasant and fertile land, it yields wine, olive oil, and silk, and breeds sheep. Wool and leather manufactures are important. Flowers grow in profusion around the city of Florence (q. v.). Pop. (1928) 820,492.

Florence (Italian *Firenze*), formerly the capital of Tuscany, now the capital of the province of Florence, department of Tuscany, situated on both banks of the Arno, amid the pleasant slopes of the Apennines, on railroads connecting it with Rome, Bologna, Leghorn, and other cities; 40 miles from the Ligurian Sea, and 65 miles from the Adriatic. It is subject to sudden changes of temperature, and has relatively cold winters and hot summers.

The city, originally on the right bank of the river, was extended to the left bank in the Middle Ages. Since the demolition of the ancient walls in 1865, it has spread extensively, especially toward the north and east, and since 1888 the former narrow and unsanitary quarters which constituted the heart of the city, and the site of the Ghetto, have been entirely modernized. Boulevards follow the line of the old fortifications, but several of the mediæval gates remain. The busiest squares and streets are the Piazza Vittorio Emanuele, the Piazza della Signoria (the site of the Roman forum), and the Piazza del Duomo; the Via Tornabuoni (containing handsome residences and shops), Via de' Calzajoli, Via de' Cerretani, Via degli Strossi, and Via Por Santa Maria. Six bridges span the Arno, the oldest and most famous of which, the Ponte Vecchio—lined since the fourteenth

century with goldsmiths' and curio shops—has been the site of a bridge since Roman times. Modern quays along the river are occupied by attractive shops and dwelling places. Interesting monuments are the Dante in the Piazza di Santa Croce (1865); the Zocchi statues of Garibaldi and Victor Emanuel (1890); Romanelli's bronze bust of Benvenuto Cellini on the Ponte Vecchio (1901); the granite column taken from the baths of Caracalla in Rome, and set up (1563) in the Piazza Santa Trinita and the huge statues adorning the Loggia dei Lanzi.

The chief architectural feature is the Cathedral in the Piazza del Duomo, one of the largest churches in Italy, erected chiefly between 1296 and 1436. Its interior is adorned with several fine pieces of sculpture by Michelangelo, Ghiberti, Sansovino, Della Robbia, and others, and with two bronze doors. Its detached Campanile, Giotto's greatest work, was built between 1334 and 1387, and is 276 feet high. Near the west end of the Cathedral stands the Baptistery, which served as the cathedral of the city down to 1128. It has still more famous bronze doors, three in number, the work of Ghiberti and Andrea Pisano. Among the other famous churches are those of Santa Croce (1294–1442), the Pantheon of Florence, adorned with frescoes by Giotto, the Gaddis, and others; Santa Maria Novella (1278–1350), in pure Tuscan Gothic, with frescoes by Ghirlandajo and Orcagna, and a Madonna by Cimabue; Santa Maria del Carmine, which contains frescoes by Filippino Lippi, Masolino, and Masaccio; San Lorenzo, originally founded in the end of the fourth century (it shelters the Laurentian Library, which contains many valuable classic MSS.); the New Sacristy, built in 1523–9 by Michelàngelo to serve as the mausoleum of the Medici, also belongs to this church; the Church of the Annunciation (1250), decorated with frescoes by Andrea del Sarto; the Church of the Trinity, with frescoes by Ghirlandajo; of the Holy Spirit (fifteenth century); of Or San Michele, with Orcagna's famous tabernacle; the Monastery of St. Mark, decorated with Fra Angelico's frescoes; and the fine Romanesque Church of San Miniato, outside the city.

These edifices testify to the prominence of Florence in the world of art, a position which is still further enhanced by the glorious canvases and sculptures of the Academy of Fine Arts; by the treasures of the Uffizi Palace (1560), one of the most valuable collections of painting and sculpture in the world; and the even more valuable collection of the Pitti Gallery (1440). Other notable buildings of the city are the castle-like Palazzo Vecchio (1298–1314), the seat of the city's government until 1532, now the Town Hall; the cloistered hall of Dei Lanzi (1376), with Benvenuto Cellini's *Perseus*, and other masterpieces of sculpture (it was in this square Savonarola was burned in 1498); the Uffizi Palace (1560–74), containing the National Library, a picture gallery, the central archives of Tuscany, and the post office; the archæological museum, which contains notable Etruscan collections; the national museum of the Middle Ages and the Renaissance, sheltered in the Bargello (thirteenth century), the ancient chief law court of the republic; and a number of interesting palaces, including the Riccardi (1430), Strozzi (1489–1533), Rucellai (1450), and Corsini (with a good picture gallery). The Pitti Palace on the Boboli Hill, designed by Brunelleschi (fifteenth century), is the residence of the king when he is in the city.

Florence; Ponte Alla Carraia

Florence ranks as the intellectual capital of Italy, a position it owes not only to the natural gifts of its inhabitants, but also to the memory of its greatest citizen, Dante, and to the fact of its being the seat of the (national) Accademia della Crusca, and the vigorous Institute for Advanced Studies, which virtually fulfils the offices of a university. It has also conservatories of music and of art, and several hospitals.

THE CATHEDRAL OF FLORENCE

Courtesy Italian Tourist Information Office, Chicago

LOGGIA DELLA SIGNORIA IN FLORENCE

Florence

Manufactured products include works in marble and alabaster, wood carving, stained glass, mosaics and *objets d'art*, majolica, laces and of straw plaiting for hats. There are also porcelain, metallurgial, jewelry and glass works. The city is the center of a large and fertile agricultural business in wine, oil and grain, and supplies the surrounding region with goods of all kinds, being itself largely dependent on the tourist trade. Pop. (1921) 253,565; (1936) 322,535.

History.—Florence was made a Roman *colonia* under Sulla. The site of the ancient town was north of the Ponte Vecchio, where remains of the capitol, temple, baths, and amphitheatre have been discovered. In the early Middle Ages it was one of the chief towns of the Tuscan margravate. After the death of the Countess Matilda (1115), Florence began to assert her independence. She made the neighboring feudal lords submit their land to her jurisdiction; forced them to take up their residence within the town; and destroyed the castles from which they had molested her merchants. The emperors, when in Italy, tried to deprive her of her communal liberties and of her Contado (the country district under her rule); but she recovered her independence as soon as they returned to Germany.

After the death of Frederick II. (1250) she became completely free, exiled the Ghibelline party among the citizens, and placed herself at the head of a Guelf League of Tuscan towns allied with the papacy, thus obtaining a kind of hegemony in Tuscany. This involved her in fierce struggles with the Ghibelline towns, especially Pisa and Siena; and once the Sienese succeeded in restoring the Ghibelline exiles and driving the Guelfs out of Florence; but the conquest of Naples by the Guelf house of Anjou enabled the Florentine Guelfs to return to their homes and banish the Ghibellines—this time forever (1268).

At length the burgher classes, who had organized themselves into guilds (*arti*), and were enriched by the prosperity of foreign trade, wrested the government from the hands of the nobles, and ruled Florence by a 'signory,' consisting of a 'gonfalonier of justice' and eight 'priors,' all members of the guilds. This form of government lasted until the downfall of the republic. By the 'Ordinances of Justice' (1292) the nobles were altogether excluded from the magistracy, and kept down by a severe penal code. The struggles of the nobles against the ordinances led to the splitting up of the citizens into factions called 'Blacks' and 'Whites' (*Neri* and *Bianchi*). In 1302 the Blacks gained the upper hand, and banished the Whites, including Dante.

For a century Florence was governed by the rich burghers, and was, on the whole, in a flourishing condition; although the fierce factional struggles, with frequent street fighting and much bloodshed, did not cease. She succeeded in extending her dominion over a great part of Tuscany. In 1406 she obtained her chief triumph, the conquest of Pisa, thus gaining a seaport. Her merchants were enriched by the manufacture of woollen and silken goods, and by the large business of banking, which they were among the first to organize on the modern system. This wealth was largely expended on the splendid buildings and fine works of art which gave Florence the leading place in the Italian Renaissance.

Unlike most of the Italian communes, Florence maintained her political independence until the fifteenth century. She suffered heavily from the Black Death (1348); and the economic complications to which it helped to give rise led to a revolt of the lower classes (the Ciompi rebellion, 1378). The reaction following this revolt caused the government to become more and more oligarchical in character; but at last the oligarchy split within itself, and a struggle between the leading family, the Albizzi, and the rich banking family of the Medici led to the banishment of the former and all their party (1440).

The wealth and liberality of the Medici gave them popularity with the hitherto suppressed lower classes; the impetus which their vast banking operations, extending all over Europe, gave to Florentine trade made them acceptable to the merchant class; and their enlightened patronage of art, architecture, and literature added still more to their popularity. With great skill and tact they extended their influence, and Lorenzo, the third of the family, had before his death (1492) made himself almost absolute master of the city. After him, however, the family deteriorated; and in the confusion of the foreign invasions of Italy the Medici were driven from Florence, which reconstituted itself into a republic, and was for some years entirely under the influence of the reforming enthusiast, Savonarola.

Too close adherence to a French alliance, however, led, in 1511, to the restoration of the Medici by Lorenzo's son, Cardinal Giuliano (afterward Leo X.), with the help of Spain. Once again the city rose and drove out the Medici; but another pope of that family, Clement VII., obtained the help of a German and Spanish army, which took the town after a brave defence of nearly a year (1530). The city then became the capital of the grand-duchy of Tuscany.

Florence, with the rest of the grand-duchy, was united to the kingdom of Italy in 1859, and from 1865 until the conquest of Rome in 1870 served as the capital of the kingdom. Since then of the province of Florence.

Among the most distinguished natives of Florence are Dante, Boccaccio, Cimabue, the Gaddis, the Lippis, Della Robbia, Donatello, Machiavelli, Ghirlandajo, Orcagna, Andrea del Sarto, Ghiberti, Benvenuto Cellini, Lully, Cherubini, Amerigo Vespucci, and Guicciardini. In the English cemetery are buried Mrs. Browning, Landor, Clough, and Theodore Parker.

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Florence, city, Alabama, county seat of Lauderdale county, on the Tennessee River, at the head of navigation for large steamers, and on the Louisville and Nashville, and the Southern Railroads; 62 miles west of Huntsville. The chief manufactures are cotton, iron, lumber, flour, wagons, furnaces, pumps, staves, fertilizers, nitrate and cottonseed oil. There are quarries and coal and iron mines in the vicinity. It is the seat of the State Normal College and the Burrill Normal School for Negroes. The city is situated on a plateau high above the river, which is spanned by a railroad and thoroughfare bridge, a few miles above are the Muscle Shoals. The military road constructed by Andrew Jackson runs through the city, and is one of its important streets. Pop. (1920) 10,529; (1940) 14,629.

Florence, city, Colorado, in Fremont county on the south bank of the Arkansas River, and on the Santa Fé, and the Denver and Rio Grande Railroads; 8 miles east of Canon City. It has oil smelters, cement factories, oil refineries, and petroleum wells. Pop. (1930) 2,475.

Florence, city, South Carolina, county seat of Florence county, on the Atlantic Coast Line, and the Seaboard Air Line Railroads; 75 miles northeast of Columbia. The chief manufactures are cottonseed products and lumber. There are railroad shops and tobacco warehouses. It is the seat of the State Industrial School. Pop. (1920) 10,968; (1940) 16,098.

Florence, WILLIAM JERMYN (1831–91), American actor, was born in Albany, N. Y., his real name being BERNARD CONLIN. He early removed to New York City, where he worked at a trade and appeared in amateur theatricals. His debut on the professional stage was at Richmond, Va., in 1849, as Peter in *The Stranger*. In 1850 he joined the company at Niblo's Garden, New York, becoming one of the most popular and versatile members of his profession. In New York, up to his marriage (1853) with Mrs. Malvina (Pray) Littell, he played with Forrest, Brougham, Barney Williams, Mrs. Mowatt, and others. He and his wife then began starring, playing with success in *The Yankee Housekeeper*, in which they also appeared in London, *The Ticket of Leave Man, Caste, The Mighty Dollar*, and many other pieces until Mrs. Florence's retirement in 1888. Florence then entered into a partnership with Joseph Jefferson, which lasted until Florence's death.

Florence of Worcester (d. 1118), old English chronicler and monk who spent nearly the whole of his life in the monastery of Worcester. His *Chronicon* begins from earliest times, and comes down to 1107. Prior to his own age his work is simply a compilation from the *Anglo-Saxon Chronicle*, Bede, and other historians, but from 1082 to 1107 he writes of contemporary events and from that date until 1141 his work was continued by his brethren in the monastery. It was translated and edited by T. Forester for Bohn's Library, by B. Thorpe for the British Historical Society, and by J. Stevenson in his *Church Historians of England* (1853).

Florence Station, village, Tennessee, in Rutherford county, on the Nashville, Chattanooga and St. Louis Railroad; 5 miles northwest of Murfreesboro. Near it was fought the Battle of Stone River (q. v.).

Flores, flō'rās, department, Uruguay, bounded by the departments of Durazno, Florida, San José, Soriano, and Rio Negro; area, 1,744 square miles. The principal rivers are the San José and the Yi with their tributaries. The department is chiefly pastoral; but much of the land is suitable for agriculture. The capital is Trinidad. Pop. (1935) 32,760.

Flores, an island of the Azores in the district of Horta; 57 sq. miles. It is the most westerly of the group and the capital is Santa Cruz das Flores. Off Flores, in 1591, occurred the famous sea fight between the *Revenge*, commanded by Sir Richard Grenville, and several large Spanish ships. Pop. 6,662.

Flores, island, Dutch East Indies, south of Celebes, forming, with Solor and Alor, a district of the residency of Timor; area, about 5,800 square miles. The trade, chiefly with Celebes, consists of imports of manufactured goods, and exports of fish, tortoise shell, and cinnamon. The capital of the district is Larantuka, at the eastern extremity. Pop. 433,038.

Flores, JUAN JOSÉ (1800–64), Spanish-American soldier, was born in Puerto, Cabello, Venezuela. Originally impressed for service in the Spanish army, he escaped in 1815, and took service in the army of New Granada under Ricaurte. He fought in the campaigns from 1819 to 1823, rising to be second in command in the victorious campaign of Ibarra. Concluding the war in 1824, he became commanding general of Ecuador in 1825, and was president from 1830 to 1835 and again from 1839 to 1845. He retired to Europe for some fifteen years but returned to Ecuador in 1863.

Flores, VENANCIO (1809–68), Spanish-American soldier, was born in Paysandu, Uruguay. He became leader of the 'Colorados,' the party of revolt and in 1853 seized the presidency of Uruguay, but was driven out in 1855, and retired to the Argentine Republic, whence he twice led unsuccessful expeditions into Uruguay. In 1865, while Brazil and Uruguay were at war, he again usurped the presidency of the latter country. He resigned office in 1868 and was assassinated a few days later.

Florets, the little individual flowers that make up the more dense inflorescences, as in the capitula of daisies or dandelions.

Florez, flō'rāth, HENRIQUE (1701–73), Spanish historian and priest, was born in Valladolid. He was an Augustinian friar and became teacher of theology at the University of Alcala. His principal work is *España Sagrada—theatro geografico—historico de la iglesia de España* (29 vols. 1747–73), a historical presentation of the Spanish bishoprics.

Florian, flō'ryän', JEAN PIERRE CLARIS DE (1755–94), French novelist, was born near Paris. He was a relative of Voltaire by whom he was somewhat influenced. He began his literary career while yet young, his *Numa Pompilius* and *Gonzalve de Cordove*—romances in the style of the French classic school—being published before he was three-and-twenty. His fame rests, however, on his *Fables* (1792), which take rank among the best in the language, being characterized by aptness, piquancy, and point. He also translated *Don Quixote* into French, and wrote several plays and poems in the pastoral style. He was elected to the Academy in 1788. In the revolutionary troubles of 1789 he was arrested as a suspect, but escaped the death penalty.

Florianop'olis (formerly DESTERRO), city, Brazil, capital of the state of Santa Catharina, on the sloping western shore of Santa Catharina Island, opposite San José on the mainland. It is a modern city, and has a cathedral, a public library, a hospital, and the governor's palace. The harbor is deep and well protected but is somewhat impeded by bars at the north and south. The town is the commercial headquarters of the state. The imports consist of textiles, iron and steel, jewelry, crockery, flour, paints and oils, and coal; and the chief exports are tea, timber, coffee, mandioca flour, hides, rice, sugar, and tobacco. Pop. (est. 1930) 46,520.

Floricans, flō're-kanz, East Indian birds, nearly allied to the bustard, which are greatly relished as food, and which are also hunted for the sake of sport. Two species are known, the Bengal Florican (*Houbaropsis bengalensis*) and the Lesser Florican (*Sypheotis aurita*). They are long-legged birds, inhabiting grassy plains, remarkable in that no true permanent pairing occurs, the sexes living apart in separate flocks even during the breeding season. The male becomes almost black in spring, while females retain the ordinary bustard-like plumage.

Floriculture, the cultivation of flowers and decorative plants for æsthetic purposes. The growing of flowers has been carried on from early times in most civilized countries but as a business development the industry dates from the last century. It is carried on in the United States chiefly under glass; and successive improvements in greenhouse construction have resulted in the rapid expansion of the plant and cut-flower industry. Roses, carnations, violets, chrysanthemums, orchids, and lilies are popular.

Florida

In France, an important centre of supply for bulbs and cut flowers, neither greenhouses nor glass frames are commonly used; but the beds are protected from frost by coverings of straw or reed matting. The French Riviera, by means of the parcel post, supplies narcissi, hyacinths, violets, gladioli, and immortelles to the European capitals. Flowering bulbs and immortelles are shipped in large quantities to the United States. Bulbs are also extensively cultivated in the Netherlands, a large portion of the tulip bulbs and practically all the azalea plants coming from there to the United States. See FORESTRY; GARDENING; LANDSCAPE GARDENING. Consult Henderson's *Practical Horticulture;* Taft's *Greenhouse Management;* Page's *Home Floriculture* (1911); Ely's *Practical Flower Garden* (1911); Adams' *Flower Gardening* (1913); Frothingham's *Success in Gardening* (1913); Holland's *The Garden Blue Book* (1915); White's *The Principles of Floriculture* (1915).

Florida (popularly called the 'Peninsula State'), the most southerly State of the United States, is situated between the parallels of 24° 30′ and 31° N., and the meridians of 79° 48′ and 87° 38′ W. It is bounded on the north by Georgia and Alabama; on the east by the Atlantic Ocean; on the south by the Strait of Florida and the Gulf of Mexico; and on the west by Alabama and the Gulf of Mexico. It covers an area of 58,666 square miles, of which 3,805 are water surface. The State is divided into 67 counties. Its coast line is 3,751 miles long.

Topography.—The surface of the State of Florida is generally level except in the northwestern part, which is somewhat hilly. Throughout the whole State there are no elevations exceeding 300 feet in height, and the average elevation of the land surface above sea level is less than that of any other State with the exception of Louisiana. A central ridge from 100 to nearly 300 feet in height, with a north and south axis, extends far into the State from the northern boundary. The southern part is marked by large cypress swamps and everglades (see EVERGLADES). The central portion is noted for its immense number of lakes. Lake Okeechobee (q.v.) is the largest in the State and one of the largest wholly within the United States.

Of the rivers, the most important is the St. Johns (q. v.), navigable for nearly 250 miles. Others are the Withlacoochee, Escambia, Choctawatchee, Apalachicola, Suwannee, and Black Water. There are about 1,150 miles of sea coast, more than half being on the Gulf of Mexico. On the east coast are the harbors of Fernandina, Jacksonville, and Miami; on the west coast, Tampa, Key West, Apalachicola, and Pensacola. Because of its strategic position Key West is one of the most important harbors in the United States.

Climate and Soil.—The climate is one of the most equable on the continent, and is remarkably healthful. For this reason Florida is a favorite winter resort. The mean annual temperature for the State is 71° F. Rainfall is heavy, averaging 53 inches annually. St. Augustine, Ormond, Daytona, Palm Beach, Miami, Tampa, Orlando, St. Petersburg, and Fort Myers are the principal tourist resorts.

The soils are generally sandy and light, except in the northern part, where loams and clays predominate, and in the Everglades region, the soil of which is composed of muck and peat. Reclaimed savannas make valuable lands; while some of the hill lands are of fine quality and support heavy vegetation.

Geology.—The formations of Florida are of late geologic age, the exposed rocks belonging to the Eocene or to later periods. The underlying formations are limestones, and the rocks are all of sedimentary origin. Coral formations occur in a limited portion of the strata edging the Everglades, and along the keys of the extreme southern part of the State. The principal mineral deposit is phosphate.

Mining. — The State's chief mineral product is phosphate rock. The output in 1938 totaled 2,707,335 long tons, and the value of phosphates produced in that year was approximately $13,300,000. Surpassed by only Tunisia as a source of this product, Florida exports about 1,000,000 tons annually for fertilizing purposes in times of peace. The State also is rich in lime and limestone, and its deposits of kaolin and fuller's earth have some importance.

Forestry.—The State's output of lumber in 1938, consisting largely of yellow pine and cypress, totaled around 700,000,000 board feet and had an approximate value of $21,000,000. The national forest area covered 988,403 acres in June of 1937.

Fisheries.—Florida ranks high among the States in the value of its fishing interests. It has a natural monopoly on the sponge fisheries, contributes most of the mullet product, and provides oysters, shad, turtles, and red snappers. The fisheries produce an annual catch averaging an estimated $20,000,000 in value.

Agriculture.—Florida leads all other States in the growing of grapefruit and is second only to California in the production of oranges. During the 1939–40 season the State produced 17,300,000 boxes of grapefruit valued at $21,381,000 and 35,920,000 boxes of oranges (including tangerines) valued at $35,920,000. The quantities and values of other leading crops as of 1939–40 were as follows: tomatoes, 4,950,000 bushels, $12,235,500; snap beans, 7,135,000 bushels, $7,041,500; celery, 2,185,000 crates, $5,375,000; corn, 6,038,200 bushels, $4,347,300; tobacco, 23,411,000 pounds, $2,810,000.

Florida's livestock showed the following distribution in January of 1939: 694,300 cattle, 112,250 milch cows, 566,500 swine, 38,000 sheep, 19,100 horses, 41,500 mules.

Manufactures.—Among products manufactured in Florida those produced most profitably (aside from lumber above described under FORESTRY) are turpentine, rosin, cigars, paper (made from pine pulp), and tung oil (prepared from the seeds of *Aleurites cordata*) which is useful for waterproofing paper and for speeding the drying process in paints and varnishes. In the year ending April 1, 1939, the State produced 7,440,250 gallons of gum turpentine, valued at $1,660,500; 507,000 barrels (500 pounds each) of rosin, valued at $4,450,300, and cigars valued at more than $20,000,000.

In the year 1937, according to the Biennial Census of Manufactures, there were in Florida 1,889 manufacturing establishments employing 52,005 wage earners whose total earnings for that year were $36,501,359 In this connection the total cost of materials, containers, fuel, electric energy, and contract work was $113,137,975; the total value of the manufactured products was $217,044,982; and the value added by manufacture was $103,907,007.

Tourist Trade. — Of prime importance as a source of income to the State is the annual influx of tourists and winter residents who in the season of 1938–39 numbered approximately 2,250,000 and brought into the State about $325,000,000. In the winter of 1939–40, due to the wartime slump in European travel, the number of Florida tourists increased to 3,000,000, whose estimated spending in the State totaled $365,000,000. The most important tourist centers are Miami Beach, Fort Lauderdale, Palm Beach, West Palm Beach, Daytona Beach and St. Augustine, all on the East Coast; Key West, the southernmost of all cities in the United States; and Clearwater, St. Petersburg, Tampa, and Sarasota on the West Coast.

NASTURTIUM
Tropaeolum majus

PANSY
Viola tricolor

Courtesy Chicago Park District

ORCHID
Cattleya triana

JAPANESE PRIMROSE
Primula japonica

Florida

Communications. — According to the latest State Census there are 5,406 miles of steam railway and 200 miles of electric railway in Florida. The Atlantic Coast Line, the Seaboard Air Line, the Louisville and Nashville, the Florida East Coast, and the Georgia Southern and Florida are the principal railroads.

Hard-surfaced highway totaling 8,631 miles is maintained by the State, and there are 80 commercial and municipal airports within its borders.

State Finances.—For the fiscal year ending July 1, 1939, the status of finances in Florida was as follows: balance in the treasury at the beginning of the year, $5,767,105; receipts from all sources in the year, $74,987,814; disbursements, $73,992,728; balance at the end of the year, $6,762,191.

The assessed value in 1938 of all property in Florida was $530,618,446. Included in this total was real property valued at $440,272,079 and personal property valued at $52,584,564. Railway and telegraph properties in the State had an assessed valuation of $37,761,803.

Banking.—Deposits in Florida's 52 national banks totaled $241,035,000 on June 30, 1939; loans and investments of these banks totaled $58,621,000 and $122,382,000 respectively; concurrently Florida's 112 licensed State banks and trust companies had deposits of $88,077,000, loans of $26,926,000, and investments of $29,115,000.

Population.—Florida had an estimated population of 1,877,791 in the 1940 Census as compared with a population of 1,606,842 as shown by the State Census of 1935. The largest cities in the State (1940) and their respective population figures were: Jacksonville, 174,336; Miami, 170,877; Tampa, 107,674; St. Petersburg, 59,178; Pensacola, 37,173; Orlando, 36,302; West Palm Beach, 33,208.

According to the Federal Census of 1930, the total population of Florida was 1,468,211. Of this number 431,828 were Negroes, compared with 329,487 Negroes in a total of 968,470 in 1920. The population of 1930 included 185 Mexicans, 587 Indians, 200 Chinese, 153 Japanese, and 46 Filipinos. Inhabitants of the Territory of Florida were first separately enumerated in 1830. The subsequent growth of Florida's population is shown in a table on this page

In 1930 there were 14 cities in Florida whose inhabitants numbered 10,000 or more: namely, Jacksonville (129,549), Miami (110,637), Tampa (101,161), St. Petersburg, Pensacola, Orlando, West Palm Beach, Lakeland, Daytona Beach, Key West, St. Augustine, Tallahassee, Gainesville, and Sanford.

Defense.—On the last day of June in 1939 the National Guard of the State of Florida consisted of 181 officers, 2 warrant officers and 2,340 enlisted men.

Old Age Assistance.—In 1935 Florida established a system of Old Age Assistance, providing thereby for monthly payments not to exceed $35 to 'those infirm and those not younger than 65 who, being citizens, have lived in the state and county ten years.' On Sept. 1, 1937, citizens to the number of 11,862 were drawing an average of $14.47 per month.

Education.—During the school year 1937–38 there were 21 kindergarten schools in Florida, with 24 teachers and 821 pupils; 2,023 elementary schools with 8,357 teachers and 261,364 pupils; 468 junior high schools with 2,219 teachers and 85,301 students; and 325 senior high schools with 2,497 teachers and 49,350 students.

During the school year 1937–38 the average salary received annually by principals and teachers in all schools of Florida was $1,001. The State appropriation for public education in the biennial period 1937–39 was $11,607,387 ($11,298,304 for the teachers salary fund and $309,083 for textbooks). Expenditures by cities and counties for educational purposes in 1935 (quoting from State Census figures for that year) totaled $18,622,155.

Departments for the training of teachers are maintained at these institutions: Florida State College for Women at Tallahassee; University of Florida at Gainesville; and the Florida Agricultural and Mechanical College (for Negroes only) at Tallahassee.

POPULATION OF FLORIDA: 1830 TO 1940

CENSUS YEAR	POPULATION	INCREASE OVER PRECEDING CENSUS	
		Number	Per cent
1940	1,877,791	409,580	27.9
1930	1,468,211	499,741	51.6
1920	968,470	215,851	28.7
1910	752,619	224,077	42.4
1900	528,542	137,120	35.0
1890	391,422	121,929	45.2
1880	269,493	81,745	43.5
1870	187,748	47,324	33.7
1860	140,424	52,979	60.6
1850	87,445	32,968	60.5
1840	54,477	19,747	56.9
1830	34,730	.....	.....

The State's most important institutions of higher learning, in addition to those above mentioned, are: John B. Stetson University (q. v.) at De Land; Rollins College at Winter Park; and Southern College at Clearwater. There are also several small private colleges. For recent statistics on educational institutions in Florida see table under the heading COLLEGES AND UNIVERSITIES.

As regards the distribution of Florida's school-age population in terms of age, sex, and race, as shown by the National Census:

Urban and rural school attendance for the State in 1930 showed a total of 460,181 from five to twenty years of age. Of these, 227,000 were male and 223,172 female. The total number of white persons between those ages was 284,999; of these, 201,540 (70.7 per cent) attended school. Of the total Negro population (140,362) between those ages, only 78,382 (55.8 per cent.) attended school. Illiterates ten years of age and over numbered 83,242 (7.1 per cent) in 1930 as compared with 71,811 (9.6 per cent) in 1920.

The State of Florida maintains separate schools to offer education to its white and colored pupils.

Courtesy St. Augustine Chamber of Commerce

OLD SPANISH QUARTER OF ST. AUGUSTINE

Courtesy Jacksonville Chamber of Commerce

TROPICAL PARK IN JACKSONVILLE

Courtesy Brookshire Travel Service

LOOKING NORTH ALONG MIAMI BEACH ON THE ATLANTIC OCEAN. THIS BEAUTIFUL FLORIDA RESORT IS SITUATED ON A LONG NARROW ISLAND THAT PARALLELS THE MAINLAND. THOUSANDS OF PEOPLE FROM ALL OVER THE WORLD VISIT FLORIDA EVERY YEAR

Attendance at school is compulsory. Once every school day all public schools hold Bible readings without sectarian comment.

Charities and Corrections.—The State charitable and penal institutions comprise the Blind, Deaf, and Dumb Institute, at St. Augustine; the Florida State Hospital, at Chattahoochee; the State Farm Colony for Epileptics and Feeble-Minded, at Gainesville; the Florida Industrial School for Boys, at Marianna; the Industrial School for Girls at Ocala; the Florida State Prison, at Raiford. There is a Sailors and Soldiers' Home at Jacksonville. Able-bodied convicts are employed on the public highways, under the supervision of the State Road Department, while sick and disabled convicts are kept at the State Farm and Hospital, at Raiford.

Government.—The present constitution of Florida went into effect in 1887. Amendments may be proposed by either branch of the legislature; and, after being agreed to by a three-fifths vote of each house, must be ratified by a majority vote of the electorate. A convention to revise the constitution may also be summoned, if two-thirds of the members of both houses decide that a revision is desirable, and if the electorate concur. Some minor amendments were adopted in 1930. Marriages between white and colored persons are prohibited. Railroad and transportation companies are forbidden to issue passes to any State official. The legislature is prohibited from creating any office the term of which is more than four years.

The executive officials are the Governor, Secretary of State, Treasurer, Comptroller, Attorney-General, Superintendent of Public Instruction, and Commissioner of Agriculture—all elected for four years. The governor has the usual veto power. He also has the right to remove for cause any State officer, not liable to impeachment, if the senate concur.

The legislature consists of a Senate whose members, numbering 38, are elected for four years, and a House of Representatives, consisting of 95 members, elected every two years. Regular sessions are held biennially, and are limited to sixty days. Special sessions cannot extend longer than twenty days. A two-thirds vote of the members present in each house overrides the governor's veto.

The judicial power is vested in a Supreme Court, elected for six years, Circuit Courts, Courts of Record, Criminal Courts of Record, County Courts, County Judges, and Justices of the Peace. The Supreme Court consists of five justices; there are seventeen circuit courts, and seventeen judges, appointed by the governor and holding office for six years. In such counties as there are courts of record there are no county courts. The senate tries all impeachments.

Under the Reapportionment Act of 1911 Florida had 4 Representatives in the National Congress. On the basis of the 1930 census the number was raised to five. Tallahassee is the State capital.

History.—Florida was named by Ponce de Leon, who landed on its shores early in 1513, and took possession of it for the king of Spain on the festival day called by the Spanish *Pascua de Flores* ('Feast of Flowers'). Basing his belief on the wonderful stories he had heard, he thought he had discovered a land teeming with gold, and containing magic springs which would insure eternal youth. In search of these he wandered about for some time, but finally abandoned the project and sailed for Spain. In 1521 he again led an expedition to the country, only to incur the hostility of the natives, in conflict with whom he received a fatal wound.

In 1528 another Spaniard, Pánfilo Narvaez, entered what is now Clear Water Harbor, and attempted to conquer the country. He met with fierce resistance, however, and in trying to escape was shipwrecked near the Penuco River, both he and the majority of his force losing their lives. Hernando de Soto, in 1539, anchored in Tampa Bay with about 1,000 men; and, marching through the interior, passed over the northern border, and then continued on to the Mississippi River. In 1559 an attempt at settlement was made on the shores of Pensacola Harbor by Don Tristan de Luna, but the settlement was broken up by the natives.

In 1564 a band of French Huguenots built Fort Caroline on the St. John's River, but in 1565 the colony was attacked by the Spanish under Pedro Menendez de Aviles, who massacred the settlers. The first permanent settlement at St. Augustine was founded at this time. In 1696 another Spanish colony was established at Pensacola.

Until 1763, when Florida was ceded by Spain to Great Britain, almost incessant warfare was carried on between the colonists and the Indians and people of the British colonies. The British divided Florida, which then embraced part of the present Alabama and Mississippi, into two provinces—East and West Florida—with the Apalachicola River as the boundary.

During the Revolution, Florida was the starting point for many of the expeditions which raided the large towns in the neighboring Carolinas and Georgia. In 1783 Great Britain retroceded Florida to Spain; and in 1795 Spain ceded to France all the territory lying west of the Perdido River. In 1812 the United States took possession of the lands between the Pearl and Perdido Rivers, claiming that they were included in the Louisiana territory.

During the War of 1812 a British fleet took possession of Pensacola. Gen. Andrew Jackson, with about 5,000 Tennessee volunteers, hurried to the town, and wrested it from British control, but later withdrew to New Orleans. Pensacola was again taken by Jackson in 1818, and the following year Spain sold the region to the United States for $5,000,000, possession being given in 1821. On March 30, 1822, Congress organized the Territory of Florida.

In 1835 war broke out with the Seminole Indians. The Indians massacred the American forces under Major F. L. Dade near Fort King, and several hotly contested battles were fought before they were finally subdued, in 1842. (See Seminole Wars.)

On March 3, 1845, Florida was admitted to statehood. On Jan. 10, 1861, an ordinance of secession (q.v.) was adopted by a convention at Tallahassee, and Florida joined the Confederacy. In 1862 and 1863 Fernandina, St. Augustine, Pensacola, and Jacksonville were captured by the Federals. In 1864 the Battle of Olustee, in which the Confederates were successful, was fought; and the Federals withdrew from the State.

On Feb. 6, 1868, Florida adopted a new constitution, and in June re-entered the Union. (See Reconstruction.) In 1876 the Supreme Court of the State overruled the canvassing board's count of the Presidential election returns, and declared the Democratic electors to be successful; but their decision was reversed by the Electoral Commission (q. v.).

The finances of the State, which had been seriously impaired by the Civil War, were greatly aided in 1880 by the sale of 4,000,000 acres of land to Philadelphia capitalists. In 1889 the discovery of extensive deposits of phosphate rock in Marion county, and later in Polk county, led to an influx of capital. On May 3, 1901, Jacksonville (q. v.) was almost entirely destroyed by fire, with a loss of $15,000,000.

In 1907 agitation against peonage in the State led to an official investigation, and in 1908 corrective legislation was en-

acted. In 1908, also, President Roosevelt established the Ocala National Forest in Marion county. In 1909 Key West was partly destroyed by a hurricane. Many persons were killed or injured, and the property loss was about $2,000,000. In 1912 Key West was connected with the mainland by the opening of the Key West extension of the Florida East Coast Railway.

During 1925 Florida was the scene of one of the most remarkable land rushes in the history of the United States, dwarfing by comparison the wildest times of early Western days. Speculation ran riot and land prices—if not values—soared to incredible heights. The boom continued through part of 1926, until the operation of economic laws brought a rude awakening. It was estimated that some $400,000,000 were spent upon building in 1925; about $50,000,000 on new railroad plants, and almost $8,000,000 on new highways. Then, on Sept. 18, 1926, a tropical hurricane swept the Florida east coast, cutting a 60-mile swath from the Palm Beach district on the north to the Miami region on the south. Nearly 400 were killed and about 6,400 injured; about 40,000 persons were rendered homeless and damage to property was assessed at $165,000,000.

On Sept. 12, 1928, another hurricane, originating in the Windward Islands, swept over the Caribbean Sea and the eastern part of Florida, destroying 1,836 human lives (Red Cross estimate), and rendering about 15,000 persons homeless; the havoc wrought to property was estimated at $50,000,000.

On Feb. 15, 1933, a sensational attempt was made to assassinate President-elect Franklin D. Roosevelt at Miami, immediately after he had delivered a speech in Bay Front Park. Five shots were fired by Giuseppe Zangara; five persons near Mr. Roosevelt's automobile were struck by bullets. Mayor Anton J. Cermak of Chicago was mortally wounded, and after his death on March 6, Zangara was executed March 20.

On Sept. 2, 1935, the Florida Keys were swept by a terrific hurricane which exacted a toll of 300 lives, including 200 war veterans employed (on relief) in construction camps. Much criticism was leveled against the Federal Government. After an investigation the report stated that 'responsibility for this disaster does not lie with any human factors concerned.'

With the exception of the period immediately following Reconstruction, Florida was consistently Democratic in national and State politics, though in 1928 every electoral vote went Republican. In 1932 and 1936, however, every electoral vote went to the Democrats.

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Florida, The, a Confederate cruiser, built (as the *Oreto*) at Liverpool, whence she sailed in March, 1862, the British Government failing to stop her. At Nassau, whither she first proceeded, she was seized, but was soon released. Before her capture by the U. S. S. *Wachusett* (Capt. Napoleon Collins) in the harbor of Bahia, Brazil, on Oct. 7, 1864, the *Florida* did great damage to the shipping of the United States. Four of the five arbitrators at the Geneva Tribunal decided that, with regard to the *Florida*, Great Britain failed to discharge her duty as a neutral toward the United States. See Alabama, The.

Florida, department, Uruguay, with grassy plains on which cattle are raised. It is connected with Montevideo by two railroads. Area, 4,673 square miles. Pop. (1938) 101,638. The capital, of the same name, stands 70 miles north of Montevideo. Pop. about 13,500.

Florida, Cape, southern point of Biscayne Key, off the southern part of the east coast of Florida; 10 miles southeast of Miami.

Florida Channel, or Florida Straits, between Florida and Cuba and Bahamas—parts being known as Bahama Channel and the Straits of Bemini. An arm of the Gulf Stream flows through it at the rate of from two to five miles an hour.

Florida Keys, coral or limestone reefs, extending from Cape Florida almost continuously in a curve for about 230 miles. About 50 islands are habitable, the principal being Key Largo, Saddle Bunch Keys, and Key West, with the harbor of Key West (q. v.). They are of Pleistocene or recent geological formation. The railroad to Key West, completed in 1910, crosses 41 keys. The native industries are sponge fishing and wrecking.

Florida, University of, a State institution for men, opened in 1853 at Ocala, Florida. It was moved to Gainesville in 1905. It consists of a Graduate Division, Colleges of Arts and Sciences, Agriculture, Engineering, Law, Education, Business Administration, Schools of Architecture, Forestry, Pharmacy, a division of University Extension, an Agricultural Experiment Station, and an Agricultural Extension Service. The University owns approximately 6,956 acres of land apportioned thus: campus proper, 373 acres; Agricultural Experiment Station and Agricultural Extension Service, 2,924 acres; School of Forestry, 3,659 acres. For recent statistics see table under the heading Colleges.

Florideæ, one of the three groups into which the class of Algæ is divided. Most of the Florideæ inhabit the sea. The group is distinguished by the fact that the male cells, or spermatia, and the female organs are both without mobile powers. In most of the Florideæ the green of the chlorophyll is masked by a red coloring matter.

Floridia, town, Sicily, 7 miles west of Syracuse. Pop. (1936) 14,473.

Florin, an English silver coin, value two shillings, first minted in 1849, and deriving its name from the gold coins of 54 grains weight issued in Florence in 1252. The double florin of four shillings authorized in 1887 was discontinued in 1893. A gold florin, value six shillings, issued in the time of Edward III, was soon withdrawn.

Florio, Caryl (family name William J. Robjohn) (1843–1920), American organist and composer, born in England. He was the first boy soloist at Trinity Church, N. Y. (1856–60). He produced his own opera *Uncle Tom* in 1881. He organized the Palestrina choir (1886); served as director of music at Wells College (1889–91), and for George W. Vanderbilt (1896–1901). After 1909 he was organist at St. Lawrence's Church, Asheville, N. C.

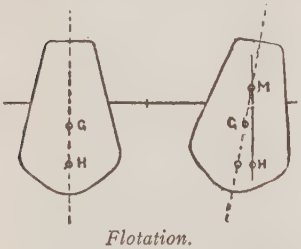
Florio, Giovanni (1553–1625), Anglo-Italian author and

translator, was born in London. He was appointed (1603) teacher in Italian to Queen Anne, wife of James I, and instructed Prince Henry, the heir apparent. He was a prolific writer. His earliest work (1578) is entitled *First Fruites which yielde Familiar Speech, Merrie Proverbes, Wittie Sentences, and Golden Sayings,* to which was appended *A Perfect introduction to the Italian and English Tongues.* That with which his name is chiefly associated is his excellent translation of *Montaigne's Essays* (1603), to which there is strong reason to believe Shakespeare was indebted for many ideas. He fell a victim to the plague at Fulham.

Florius, an historian of ancient Rome. Most manuscripts call him L. Annæus Florus, others L. Julius Florus, and others L. Annæus Seneca. His preface shows that he wrote in the reign of Trajan or Hadrian. His work is an abridgment of Roman history (chiefly Livy's), from the foundation of the city to the establishment of the empire under Augustus. It is well arranged but its style is pompous and rhetorical. It was formerly a school book.

Floscularia, or Flower Animalcule, a common genus of rotifers, characterized by the fact that the wheel disc is prolonged into bristle-bearing lobes.

Flotation. The equilibrium of floating bodies depends essentially upon the fundamental principles of hydrostatics. The



Flotation.
G, Center of gravity; H, center of flotation; M, metacenter.

weight of fluid displaced must be equal to the weight of the body. This condition insures no vertical motion as a whole. The principles of hydrostatics also show how there can be no horizontal translation. For the horizontal component of pressure in a given direction has the same value at the same level on opposite sides of an immersed body; and these pressures effectively act upon the projection on the surface perpendicular to the given direction, which projection is of course the same when viewed from opposite sides. A further condition is necessary to insure stable rotational equilibrium. The center of gravity must be as low as possible. The single resultant of all the fluid pressures acting on the body must act upward through the center of gravity of the body, so as to balance the weight. And since the vertical components of the fluid pressures balance the weight of displaced fluid, the resultant must also act upward through the center of gravity of the displaced fluid. These two centers must therefore be in one vertical line when there is equilibrium. Imagine now a vertical line drawn in the body through its center of gravity when in equilibrium. If the body be tilted slightly, the center of gravity of the displaced fluid will in general no longer be in the same vertical line as the center of gravity of the body. Hence a vertical line drawn now through the center of gravity of the displaced fluid will intersect the former vertical line in a point which is not in general coincident with the center of gravity of the body. This point is called the *metacenter* of the body. If the metacenter be above the center of gravity of the body, the weight of the body and the resultant pressure of the fluid form a couple tending to restore the body to its original position; and conversely if it be below. Hence the condition for great stability is that *the metacenter should be as far as possible above the center of gravity of the body.* This is one of the practical problems which a ship designer has to solve. When the metacenter coincides with the center of gravity, the equilibrium is neutral. See Hydrostatics. Flotation is also applied to the floating or launching of a commercial venture, a company, or a loan.

Flotow, Friedrich, Baron von (1812–83), German musical composer. His first successful opera, *Le Naufrage de la Méduse* (1839), was followed by *Alessandro Stradella* (1844) and *Martha* (1847), the last two operas winning him great popularity. He spent many years at Paris. His later operas were all popular, but only three seem destined to live—*Indra* (1853), *La Veuve Grapin* (1859), and *L'Ombre* (1869). His music is tuneful, lively, and catching. Consult *Life* by Madame von Flotow.

Flotsam, Jetsam, and **Lagan.** In English law, flotsam consists of the goods of a ship that has been lost, which are floating on the sea. The exact meaning of jetsam is doubtful. It is said to consist of goods floating on the sea which have been thrown overboard to lighten a ship that is afterward lost; but Blackstone defines it as goods cast into the sea which sink and remain under water. Lagan, or ligan, consists of goods thrown overboard to lighten a ship which is afterward lost, but which sink to the bottom, and which are marked by a buoy or cork. When any such goods are cast by the sea upon the land they become 'wreck.'

Flotsam, jetsam, and lagan in the open sea belong to the taker of them, if the owner is unknown; but in territorial waters and in havens, ports, creeks, or arms of the sea, if not claimed by the owner within a year and a day, they belong to the crown, unless they have become the property of a subject by charter or prescription. In the Merchant Shipping Act of Great Britain, flotsam, jetsam, and lagan are all included in the definition of 'wreck.'

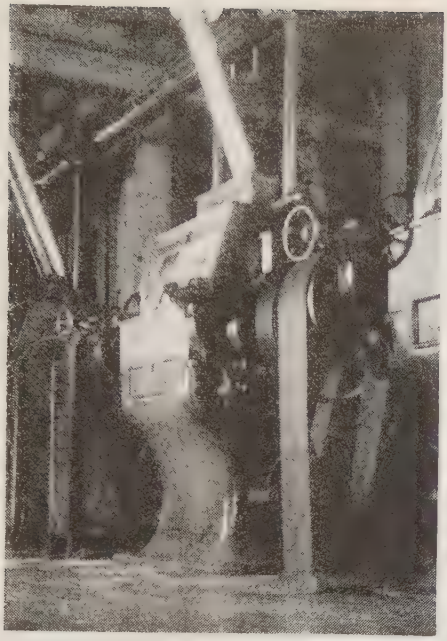
In the United States, such derelict property is subject to the laws of salvage, the owner being entitled to claim it, upon making proper compensation to the person who saved it. Such cases come under the jurisdiction of the Federal courts. No exclusive rights to claim such property are granted. See Wreck; Salvage.

Flounder, a flatfish of the family *Pleuronectidæ,* of which the halibut, turbot, and plaices are genera. With the soles, they constitute the sub-order Heterosomata. Many species of the *Pleuronectes* occur in northern seas, while others are well known on the Eastern and Western coasts of the United States. They are of small size, with the body strongly compressed and oval or elliptical in outline, and with both eyes, in the adult, on the same side of the body; usually light olive brown above, sometimes spotted. They occur on sandy bottoms near shore, and in bays.

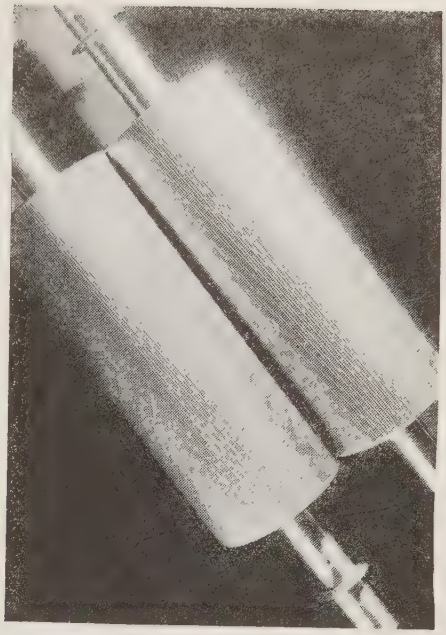
The commonest and most important species is the dark brown winter flounder (*P. americanus*) of the Atlantic coast, which rarely exceeds a length of 20 inches and a weight of 5 pounds, and which is taken largely in winter and early spring. The flounder spawns in shallow water.

Flour is the product obtained by grinding and bolting cereal grains, especially wheat.

Flour Terminology.—There are several kinds of flour, depending on the method of manufacture, on the cereal from which it is ground, on the composition of its nutritive elements, and on the uses for which it is made. Because this variety of flour names is often confusing to the homemaker, the United States Department of Agriculture in



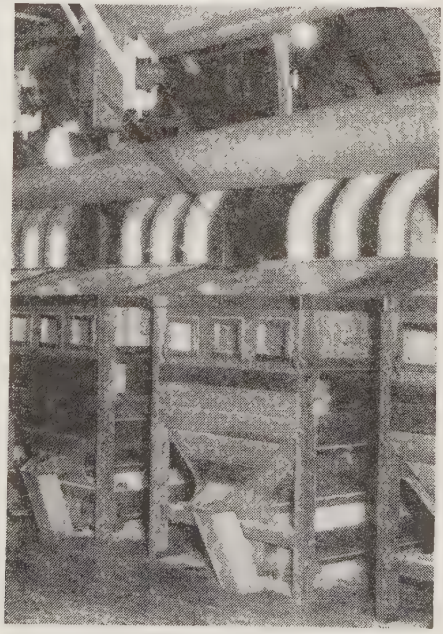
MODERN FLOUR GRINDERS



ROLLERS USED IN GRINDING

Courtesy of General Mills, Inc.

BOLTING MACHINES SIFT THE FLOUR THROUGH FINE CLOTH



PURIFYING FLOUR BEFORE IT IS PACKED FOR THE CONSUMER

coöperation with the Millers' National Federation has worked out a set of definitions. *Whole-wheat flour, entire wheat flour, graham flour* is the cleaned sound product made by grinding wheat, and contains, in their natural proportions, all of the constituents of the cleaned grain.

Flour, wheat flour, white flour is the cleaned sound fine-ground product obtained in the commercial milling of wheat, and consists essentially of the starch and gluten of the endosperm; it contains not more than 15% of moisture, not less than 1% of nitrogen, not more than 1% of ash, and not more than 0.5% of fiber. (Ash is the chemist's term for mineral matter).

Gluten flours are high protein flours from which much of the starch has been removed. *Crushed wheat* and *cracked wheat flours* are products containing 100% of the wheat berry. *Second clear flour* is a lower-grade floury product containing more than 1% ash, and under the official definition cannot be called flour, but must be branded 'second clear flour' to make plain its inferiority to white flour.

Phosphated flour is wheat flour to which a small amount of mono-calcium phosphate has been added. Self-rising flour is flour to which mono-calcium phosphate, bicarbonate of soda, and salt have been added to facilitate baking. *Phosphated flour, self-rising flour,* and *soft wheat flour* are used chiefly in the Southern States. *Rye flour* is the product obtained by grinding and bolting rye meal. *Buckwheat flour* is the ground and bolted buckwheat. *Durum wheat flour, hard wheat flour,* and *soft wheat flour* are, as implied, the floury products obtained from these three varieties of wheat.

Macaroni or *semolina flours* are milled for the manufacture of macaroni and related products. Granular and creamy in color, they are made from hard, high protein durum wheats, coarsely ground and carefully purified. *Bread flours* are milled primarily for bakers from blends of hard spring and hard winter wheats, are fairly high in protein and slightly granular to the touch; they may be bleached or unbleached.

All purpose or *family flours* are of such composition that they may be used satisfactorily for all household cookery purposes; they are lower in protein content than bread flours, but they contain enough protein for making good yeast breads, yet not too much for good quick breads and cakes. *Pastry flours* are finely milled from soft wheats, though they are not so fine as cake flour; low in protein content, they are used chiefly by bakers.

Cake flours are likewise milled from soft wheats. They are short patents, representing the most highly refined flour streams of the mill. Their granulation is uniform and very fine; their protein content low. Wheat flour, the product to which the unqualified term 'flour' is always applied, possesses peculiar properties that make it especially desirable in bread making. These properties together produce a tough but elastic dough, which, after permeation with gas, due to yeast fermentation or other gas-producing agencies, and subsequent baking, forms an exceedingly light and porous food, easily digested, and possessing all the nutritive properties of the original wheat. The nitrogenous constituents of the flour yield, when mixed with water, a characteristic product termed gluten, possessing the elasticity and tenacity essential in bread dough. The flour of most other cereals, when used for bread, is mixed with wheat flour.

But of all the cereal grains only wheat contains the kind of proteins which enable the flour from it to produce a smooth, satiny dough. Of the several proteins that wheat flour contains, the chief ones are gliadin and glutenin. When wheat flour is moistened, the gliadin and glutenin combine to form the substance we call gluten. Gluten makes the framework of bread, biscuits, cakes, and most other baked products. Bread flour yields more gluten than cake flour. Moreover, strands of gluten from bread flour are more elastic, thicker, and less tender than those from cake flour. The gluten from soft wheat all-purpose flour is more delicate and less tenacious than that from hard wheat all-purpose flour.

Each of the different classes of wheat makes a flour possessing slightly different characteristics. The hard wheats, including 'hard spring wheat' or 'Northwestern spring wheat,' Kansas 'hard winter wheat,' and 'Durum' wheat, all yield a flour more or less creamy in color, strong in quality, and high in nitrogenous constituents or gluten. The soft wheats, including the 'soft winter wheat' of the Eastern United States and the 'white wheat' of the Pacific Coast, yield a flour of whiter color, lower in nitrogenous material, and not so strong in quality.

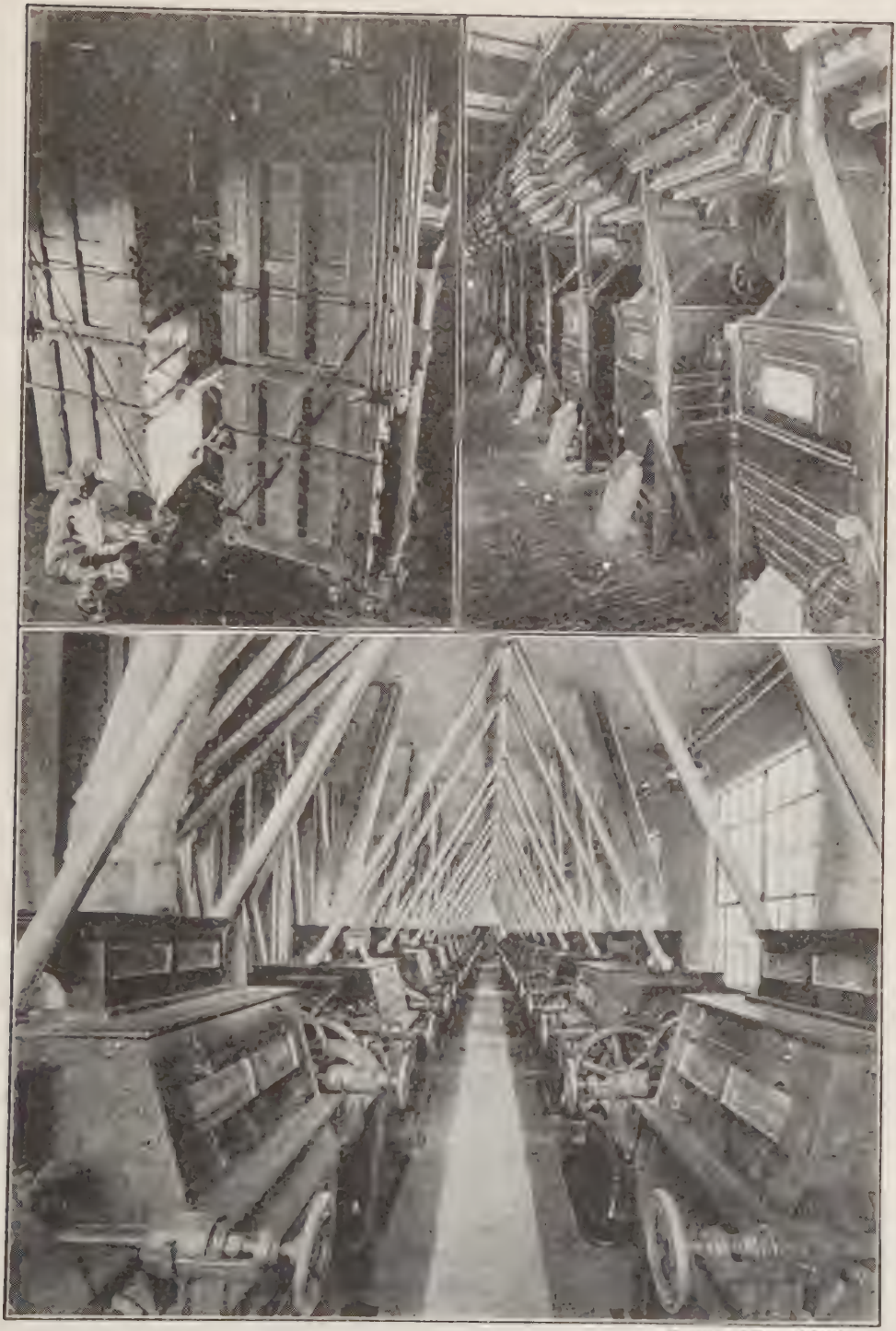
History of Flour.—The conversion of cereal grains into meal or flour for purposes of human consumption dates back to prehistoric times, when the simple *mortar and pestle* was the only means of grinding grain. This was followed by the *saddlestone,* an implement consisting of a hollowed stone on which the grain was ground into coarse meal by means of another stone worked backward and forward, and this in turn by the quern (q. v.), the first grinding device based upon the principle of rotary motion. The early type of quern, which was somewhat globular in shape, soon gave way to flat millstones, universally employed till well into the nineteenth century, and still found in some small customs mills.

Cattle, slave labor, and water power were applied to the driving of millstones by the Greeks and Romans, and water mills seem to have been in use in Northern and Western Europe before historic times. They were introduced into England in the time of Julius Cæsar, and windwills (q. v.) made their appearance there before the close of the twelfth century. In the United State horse power was used in the earliest mills, and survived in certain of the Southern States until as late as 1870. Steam was first applied to the grinding of grain in London in 1784.

In their highest development millstones are constructed of pieces of buhrstone (q. v.), cemented together and bound with iron hoops, the grinding surfaces being finely grooved or furrowed. The prepared wheat is fed automatically to the millstones, ground by the action of the top stone as it revolves upon the fixed lower or bed stone, and delivered in the form of flour which is subsequently passed through a dressing machine.

The third epoch in the history of flour making dates from the invention of the roller process and the middlings purifier early in the nineteenth century. In 1810 Ignaz Paur, an Austrian, invented a middlings purifier; experiments with roller mills were carried on in Paris, Vienna, and Switzerland as early as 1820; and roller mills were successfully used at Budapest before 1840. In 1870 a French miller named La Croix introduced the middlings purifier at Minneapolis; and improvement of the La Croix machine was later made by George T. Smith, and representatives from the largest mills in Minneapolis went to Europe to study the Hungarian system.

The flour milling process itself has had a curious history. For two thousand years or more it underwent very little essential change. From the dawn of civilization down to the middle of the



Courtesy of General Mills Inc.

INTERIOR OF AN AMERICAN FLOUR MILL, MINNEAPOLIS.

Top, left, Sifter; right, Middlings Purifier. Bottom, Grinding Machinery.

Flour

nineteenth century, the milling of grain was performed by grinding it between two stones. The size of these stones depended, of course, on the type of power used to move them, but the process itself showed little change. The purpose of the grinding was to remove the tough outer covering of the wheat berry, and separate it from the endosperm, or floury portion. Since the outer covering, or bran, not only makes the flour coarse, but also discolors it, the constant references in early literature to flour as 'fine' and 'white' show that this separation goes back to the very beginning of flour making.

The third quarter of the nineteenth century witnessed what is often called the 'milling revolution.' The old millstones gave way to steel rolls, and the separation was accomplished by a series of grindings, resulting in a gradual reduction of the wheat to flour. This process was accompanied by notable developments in the purification of the middlings, or partially ground grain, and also in the siftings to which the flour was subjected. The result was not only a vast improvement in the thoroughness of the separation between the flour and the bran, but also the opening of immense new possibilities for increased capacity.

The Milling Process.—The first step in the manufacture of flour, as it is carried on to-day, is the choice of the wheat and its blending. None but bright, plump grain is chosen, as grain discolored from heating in the stack or bin or from exposure to rain makes a low grade flour with poor raising attributes because of the injury to its gluten content. Appearance alone, however, is not a sufficient test, and the largest mills have laboratories and kitchens specially equipped to make chemical and baking tests, so as to know before milling how certain lots of wheat will turn out, and how to blend the various lots in order to maintain a uniform grade of flour.

This process of blending, begun in the 'eighties, has spread rapidly until its importance is now universally recognized and adopted. Various ways of mixing are in vogue in the several mills, the different grades of grain in separate bins being brought together in the elevator or by machinery installed for that special purpose. Thus, spring wheat, because of its relatively uniform and high content of gluten, is mixed with winter wheat, which is of special value for toning up the flour, and is reputed to give a more uniform result in the bread-making process.

In the actual process of flour manufacture the grain is elevated to the top of the mill and then carried by force of gravity from one machine to another, passing through three main operations—cleaning, tempering or conditioning, and milling proper.

Cleaning.—By this operation the wheat is separated from all extraneous matter, such as chaff, dust, bits of straw, and seeds of weeds and other grains. To accomplish this, the familiar principles of sifting and aeration are applied. The grain is passed through separators consisting of a series of specially arranged metallic sieves, and currents of air are applied at different points and in varying directions to carry off the chaff, dust, and other lighter impurities. The partially purified wheat is then passed into the cockle separator, a revolving metal cylinder lined with small indentations which catch the tiny cockle seeds, discharging them onto an apron, and thus separating them from the larger grains of wheat. The wheat grains are next scoured in a rapidly revolving cylinder, and brushed to remove dried mud and other adherent impurities.

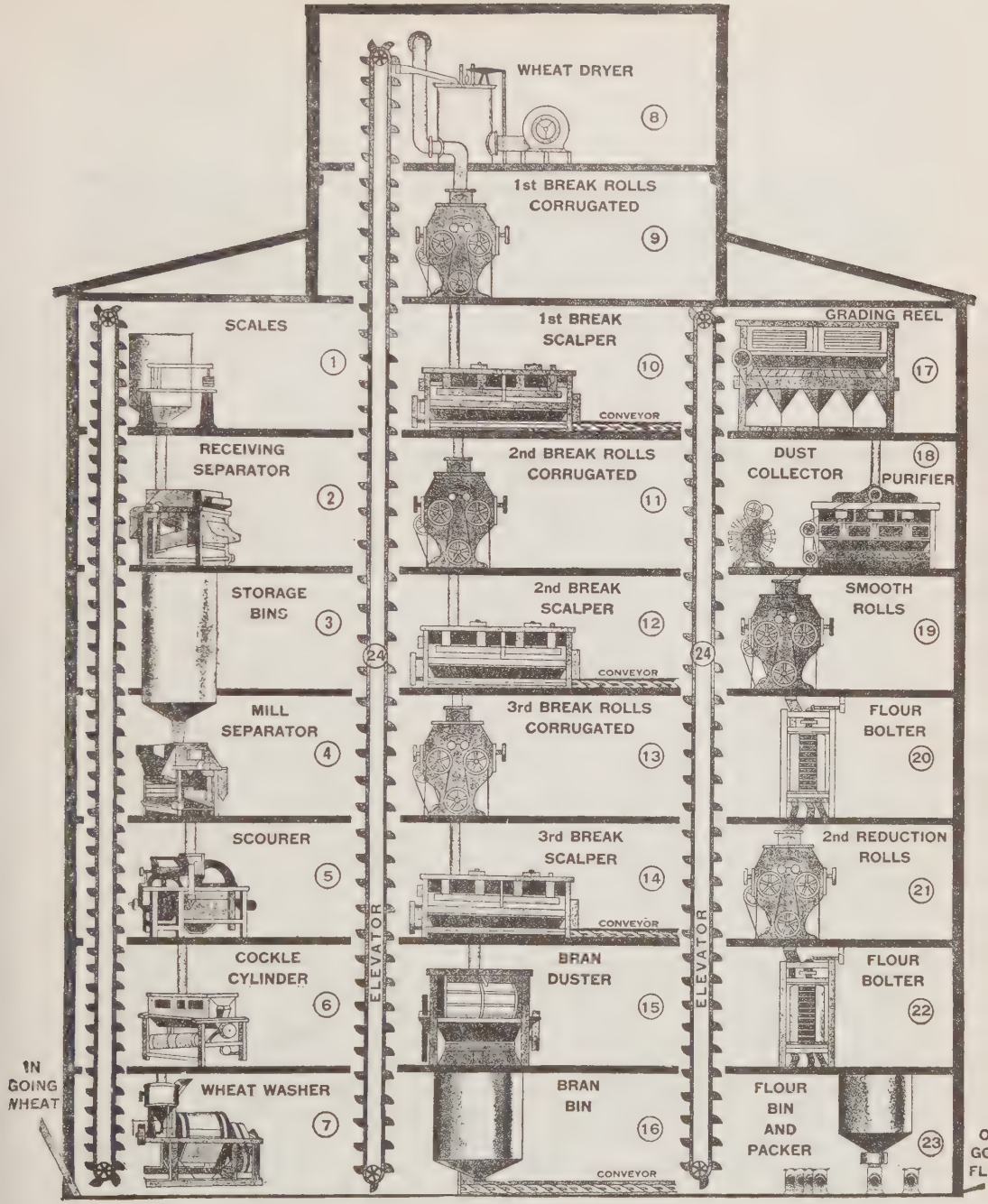
Tempering, or ***conditioning,*** consists in putting the grain into the best possible condition for grinding, to render the coats of bran tough enough to flake off in large pieces rather than be crushed to powder, and to make the inside of the kernel capable of yielding the largest percentage of flour. Tempering is accomplished in various ways, heat and moisture being the two principal factors. One method widely employed is that of washing the grain in a specially designed apparatus, either with or without preliminary dry cleaning. The grain is then conveyed to a 'whizzer,' where the excess water is discharged by centrifugal force, and is dried in drying chambers by currents of hot and cold air.

If a grain of wheat is examined under the microscope, it will be found to consist of five outer coats of bran enclosing the endosperm, which consists chiefly of gluten and starch cells with the small yellow germ of the wheat at one end. In milling the object is to remove the bran, separate the germ, which would discolor the flour and affect its keeping qualities, and crush the gluten and starch to a fine powder. This object is attained by a gradual reduction process, which aims not to produce as much flour as possible at a single grinding, but by repeated grindings or 'breaks' to separate the outer bran from the inner grain, and by purification of the latter, called 'middlings,' to secure a product that on further fine reduction yields a pure flour, free from all dirt and bran particles.

The machines that perform the first operations of crushing the grain are constructed of two pairs of chilled iron rollers, about ten inches in diameter and forty to sixty inches long. These rollers have their surfaces cut or grooved at an angle, and revolve at different rates of speed, so that when the grain is passed between them the effect is not to powder the grain at once, but to crack or crush it; the outer bran coat flakes off, and the inner endosperm portion is broken into relatively large particles and separates more or less perfectly from the bran. The wheat, after passing through the first set of rollers, is termed the 'first break,' and is then bolted on scalpers, either in the form of revolving reels or flat sieves, and separated into (*a*) flour, (*b*) middlings, which consist of portions of the floury endosperm and of finely broken bran, and (*c*) bran and unbroken wheat. The unbroken wheat is then run through a second, third, and fourth set of rollers, forming the 'second, third, and fourth breaks,' and is each time separated by scalpers into flour, middlings, and bran. The middlings from each break are purified by bolting and air currents, so that the pure white middlings are gradually separated from the bran, the shorts, and the germ. The latter then become more and more purified from adhering flour, until finally we have, on the one hand, the bran and finer particles of the cuticle layers, the shorts, with the oily germ of the grain as by-products, practically free from all flour; and on the other hand, some fine flour of low grade, and the more or less finely ground middlings practically free from the outer layers.

The purified middlings are now passed through a series of smooth iron reduction rollers, and in this way reduced to a very fine powder, which is submitted to a final dressing process through silk bolting cloth.

Portions of fine flour accumulating from the several breaks, but more or less mixed with bran and other portions of the husk, form the lower or cheaper grades of flour—the 'red dog' flour, as it is known. The branny middlings, collected during the successive reductions, form the second grade of flour, known as 'clear' flour, and the purest middlings, reduced between smooth rollers and dressed, form the fine white flour termed 'patent,'



Courtesy of General Mills, Inc.

A MODERN FLOUR MILL

1. Scales, for weighing wheat as it is received. 2. Receiving separator, for separating other kinds of seeds from wheat. 3. Storage bins, for reserve supply of wheat in advance of mill requirements. 4. Mill separator, for further separating foreign seeds from wheat. 5. Scourer, for removing dust from wheat kernels. 6. Cockle cylinder, for removing all round seeds. 7. Wheat washer, for thoroughly cleansing the wheat. 8. Wheat dryer, for drying wheat after washing. 9. First break rolls, for rupturing bran, enabling bran and germ to be separated from interior. 10. First break scalper, for sifting middlings through bolting cloth to separate from bran. 11. Second break rolls, for further loosening the middlings from bran. 12. Second break scalper, for separating more middlings from bran. 13. Third break rolls, for further loosening middlings from bran. 14. Third break scalper, for final separation of middlings from bran. 15. Bran duster, for dusting low grade flour from bran. 16. Bran bin, for packing bran for shipment. 17. Grading reel, for separating middlings by sifting through various sizes of bolting cloth. 18. Dust collector and purifier for cleaning and purifying middlings by air and sifting. 19. Smooth rolls, for grinding purified middlings very fine to flour. 20. Flour bolter, for sifting flour from purified middlings. 21. Second reduction rolls, for further grinding of purified middlings. 22. Flour bolter, for separating flour from purified middlings of second grinding. 23. Flour bin and packer, for packing flour for shipment. 24. Elevator, for raising products to the various machines.

sometimes divided into 'first patent' and 'second patent.'

Thus ***patent flour*** is the more refined portion of the wheat meal from which all or a part of the clears have been removed. How 'long' or 'short' a patent is depends on how much of the total flour is included. An '85% patent' means that 85% of the total flour obtained is included, while a '65% patent' means that only 65% of the total flour obtained from the wheat is included. The former is a 'long' and the latter a 'short' patent. From any given quantity of wheat the miller can expect a yield of approximately 70% flour and 30% feedstuff, *i.e.*, bran and shorts. This 70% flour yield is made up on the average of about '85% patent' flour, '10% first clear' flour, and '5% second clear' flour, according to the way the miller sets the flour streams—the finest streams going into 'patent,' the next best to 'first clear,' and the poorest to 'second clear' or 'red dog.' *Clear flour*, then, is the less refined portion of the wheat meal recovered in the manufacture of patent flour—and millers, according to their process or trade demand, divide this into 'first' and 'second' clears.

Latest Type Middlings Purifiers. *Courtesy of General Mills, Inc.*

Composition of Flour.—All flour consists chiefly of carbohydrates and proteins, with small

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Flour

amounts of cellulose or fibrous material, fat, and mineral matter. The average compositions of wheat, flour, and bran are as follows:

	* WHEAT	FLOUR	BRAN
Water or moisture	12.00	13.50	13.00
Mineral matter or ash	1.80	.40	5.80
Protein or nitrogenous matter	12.00	11.00	15.40
Cellulose or crude fiber	2.20	.25	9.00
Fat or ether extract	2.10	1.25	3.60
Nitrogen free extract	69.90	73.60	53.20

* C. O. Swanson, *Wheat and Flour Quality* (Burgess Publishing Co.).

Whole wheat flour actually contains more protein, according to chemical analysis, than does the white flour made from the same wheat. But the gluten formed from whole wheat flour performs less satisfactorily than does that from white flour. This is due to the fact that the tiny particles of bran tend to cut the gluten strands and thus prevent the formation of a good gluten meshwork. Consequently, baked products made entirely from whole wheat flour are never quite so light and porous as those made from white flour. People who like the flavor of whole wheat baked products often find that the most palatable bakings result when whole wheat flour and white flour are used in equal proportions.

Bleaching.—All flour has a somewhat yellowish tinge, due to the presence of plant pigments, chiefly xanthophyll and carotene. These gradually fade when exposed to oxygen. Since flour is fluffy and there are air spaces between the particles, stored flour gradually loses most of its yellowish color. Also during the storage some other changes occur which improve the baking quality of the flour. Altogether these changes are described as *aging*, or maturing. If all the flour milled were allowed to mature in warehouses, a huge space would be needed. Modern chemistry has made this time-and-space consuming process unnecessary. By treating flour with one of the well known bleaching agents, the pigments are almost instantly changed to colorless substances. At the same time the flour takes on the enhanced baking properties of a properly matured product. Flour no longer needs to be stored for months before it will make good bread or biscuits. Now it may be milled and used the same day with excellent results.

Flour testing.—In modern milling today every effort is made to produce a uniform product. The cereal chemist analyzes each run of flour and makes a record of its composition. He determines just how much protein, how much mineral, how much moisture, how much starch, how much gluten the flour contains. All this is important and helpful information. But cereal chemists are agreed that the only way to find out what kind of products the flour will make is to bake biscuits or bread or cakes or crackers or pastry from it, depending on the kind of flour it is. Accordingly, samples of each milling are sent to the baking laboratory and testing kitchens where hundreds of loaves of bread, biscuits, cakes, cookies, crackers are made each month. When miller, chemist, baker, and cook have put their approval on the flour, it is ready for market.

Substitutes for Wheat Flour.—Numerous substitutes have been suggested for wheat flour, those most generally employed being prepared from other cereals—as rye, corn, and buckwheat—and used in combination with the wheat product. *Rye flour* is milled in a manner almost identical with wheat flour, and blended with it produces a palatable and wholesome bread. *Corn flour* is prepared by pulverizing corn grits, which correspond to the middlings of wheat flour milling. A blend of 85 per cent wheat flour and 15 per cent corn flour makes a nutritious bread, similar in color and flavor to that prepared from the unmixed wheat, while corn flour alone or with a small proportion of wheat makes a palatable bread. *Rice flour* is used extensively in Great Britain and Germany. It may be mixed either with wheat flour or with wheat and corn flour, and is valuable in the making of puddings, cakes, and griddle cakes, and in commercial bread baking. *Oats* are seldom ground into flour, but the rolled oats of commerce may be used to advantage with wheat flour in making raised bread.

Other flour substitutes have been prepared from the banana, cassava, dasheen, and sweet potato, and from soy beans and peanuts; all of these being used with wheat flour in the proportion of about one to three.

Flour Output.—Compilations by the Department of Commerce for the crop year 1937–38 showed Kansas to be the most important State in the flour and millfeed industry, producing in that year 14½ million barrels of the total U. S. output of 101 million barrels. Minnesota and New York ranked second and third with 12 million and 11 million barrels, respectively. In recent years, Buffalo, N. Y., has superseded Minneapolis, Minn., as the country's number one flour milling city. It turned out, in 1937–38, 10,200,000 barrels of flour. Kansas City produced 7,480,000 barrels, and Minneapolis, 5,737,000.

Merchandising, Packaging, Etc.—Time has brought about a considerable change in merchandising and packaging flour, particularly in the United States. Flour is no longer bought by the barrel for the domestic storeroom as in days when packaging was unknown and trips to the village or city store infrequent. The housewife now buys flour in 10- and 20-pound packages. This has been made possible not only by the ability of the home buyer to get to market but by the vast increase in distribution services. In the report of the Distribution Committee of the Twentieth Century Fund, the changing role of distribution in the economic system of the United States is shown by the increasing proportion of workers employed in distribution as compared with production. In 1870, among all gainfully employed workers, approximately 75 per cent of the workers were employed in agriculture, manufacturing and other production activities, while 25 per cent were engaged in distribution and service activities. By 1930, the workers in production had dropped to 50 per cent of the total, while the proportion of workers in distribution and service activities had doubled to constitute the other 50 per cent. It is also to be noted that the export trade in flour has undergone a marked change. The rise in nationalism throughout the world and the desire of each nation to provide for itself has cut down American exports of flour as well as other products. England does much of its own grinding, and the same story applies to most of the larger European countries.

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One Hundred Years of American Commerce (1895).]

Flourens, JEAN PIERRE MARIE (1794–1867), French physiologist and anatomist, born at Maureilhan (Hérault). Proceeding to Paris, he gained entrance to the circle of St. Hilaire, Tracy, Cuvier, Jouffroy. His studies were first directed to cerebral action, normal and abnormal, also to the working of the nervous system; and in 1828–30 he was invited to lecture for Cuvier. This led to his appointment to a professorship, first in connection with the Jardin du Roi, and some years later at the Collège de France. He became permanent secretary of the Academy of Sciences (1833), and was elected to the French Academy in 1840. Among his best known works are *Expériences sur le Système Nerveux* (1825); *Analyse raisonnée des Travaux de G. Cuvier* (1841); *Anatomie Générale de la Peau et des Membranes muqueuses* (1843); *Buffon, histoire de ses traveaux et de ses idées* (1844); *Théorie Expérimentale de la Formation des Os* (1847); *Cours de Physiologie Comparée; De la Vie et de l'Intelligence* (1856), etc.

Flower, the sum of the reproductive organs of any phanerogam. These consist of a shoot or part of a shoot, comprising the perianth, the sporophylls and that portion of the axis from which they spring. All flowers may be reduced to a single simple plan, which was outlined in the article BOTANY, where it was said that a typical flower consisted of four whorls—the sepals, the petals, the androecium, or male system, and the gynœcium, or female system; and it is from the modification of one or more of these whorls that the various forms of flowers arise.

In monocotyledons the two outer whorls (the sepals and petals) are often much alike, and sometimes coherent, as in the lily of the valley. But the sepals may be green and the petals of a different hue, as in the frog-bit. It is usual to speak of these whorls as the perianth, and the parts of each whorl as perianth segments or leaves—these are usually in threes. Thus the perianth consists of six leaves. In a garden lily the outer three may be distinguished from the inner by their somewhat smaller size, and the difference is readily made out in a bud or partly-opened flower. In dicotyledons the most general number for the parts of a whorl is five. The outermost whorl (the calyx) is usually green, showing its leaf origin, though it may be white, as in the wood anemone; yellow, as in the marsh marigold; or blue, as in the larkspur. The parts may be distinct, as in the buttercup, which is said to be polysepalous; or united, as in the primrose; which is gamosepalous. There may be considerable variation from the leaflike form, as in the spurred posterior sepal of the larkspur; or the calyx may be so modified as to lose its protective character, and serve as a means for the dispersal of seed by the wind, as in the dandelion, thistle, and other composite plants.

The second whorl is formed by the corolla; its parts, which are called petals, are of a more delicate nature than the sepals, and commonly brightly colored or white. Like the calyx, its parts may be distinct or united, and are said to be respectively polypetalous or gamopetalous. On the other hand, the corolla may be wanting, as in the marsh marigold and the goosefoot. When all the parts of the calyx or the corolla are of the same shape, the flower is regular; but when the members of either of these whorls are not equal and similar, the flower is irregular. Common examples of regular polypetalous flowers are the buttercup and the apple; and the most striking irregularity is that seen in the laburnum and sweet pea. In the latter, which may be taken as a type of papilionaceous plants, distinct names have been given to the petals. The upper petal is called the standard, the two side petals are the wings, and two lower ones, often united, form the keel. In gamopetalous flowers, those like the Canterbury bell, convolvulus, primrose, and pimpernel are regular; and irregularity is evident in the deadnettle, toad-flax, and snapdragon. Although the corolla is to some extent protective, its chief end is to attract insects by its conspicuous colors and perfume. Thus in flowers that bloom at evening the petals are as a rule white, and the scent is powerful, and both act as signals to insects which come out in the dusk or at night. Another attraction often found in the corolla itself is nectar. When this is the case the glands which secrete this liquid are generally at the base of the petals, as in the buttercup; so that in order to reach it insects must brush against the stamens, and so carry off pollen to be distributed to other flowers which may be visited for food.

The two inner whorls are the essential or reproductive organs. The third whorl consists of the stamens, constituting the androecium or male system. They are inserted in various ways, but always within the corolla and outside the bistil when these are present. There may be one series or more, and a familiar example, of the latter arrangement occurs in the common poppy. A perfect stamen consists of a stalk or filament, surmounted by a two-lobed case or sac (the anther), the essential part, as in it the pollen, or male element, is formed. When this is ripe the face of the anther opens or dehisces, and the contents of the sac are discharged. Linnæus founded his classes on the number of the stamens, their grouping and insertion, the characters of the innermost whorl or female system being used to differentiate the orders. Stamens are described as hypogynous when they spring from below the base of the gynœcium, and as perigynous or epigynous, according as they are on a level with or above it. The buttercup, the rose, and the honeysuckle are respectively examples of these methods of the arrangement of the stamens, in which the third whorl seems to travel up the floral axis from a position below the fourth whorl to one on a level with, and ultimately to one above it.

Great diversity occurs in the innermost whorl, which may consist of a single carpellary leaf united by the edges, as in the pea; an aggregation of carpels, as in the buttercup; or a union of carpels, as in the lily, the tulip, and the poppy. This part of the female system is the ovary, and its upper part is the stigma, the top of which exudes a viscid fluid or is covered with hairs, the object being to secure the adhesion of the pollen. In the buttercup and poppy the stigma is sessile; in the tulip and the lily it is borne upon a column (the style). The composite character of most ovaries is readily seen on transverse section, which will also show the ovules in position.

Pollination, or the distribution of pollen and its application to the stigma, is effected in various ways. The wind is one great agent in the work, especially as regards gymnosperms, and the clouds of pollen from conifers have given rise to stories of sulphur showers. Tennyson refers to the wind-scattered pollen of the yew in the *Holy Grail*. In wind pollination there is a good deal of waste, consequently these anemophilous plants yield enormous quantities of pollen. Insects are the chief pollen distributors, and the various modifications of entomophilous plants to secure pollination border on the marvellous. Pollen is also carried from flower to flower by nectar-feeding birds, and in some few cases by snails. In the first the plants are said to be ornithophilous, and in the second malacophilous.

Fertilization results from the mixing of the contents of the pollen grain with those of a cavity in the nucleus of the ovule

SPANISH IRIS
Iris xiphium

TAHOKA DAISY
Machaeranthera tanacetifolia

All photos on this page courtesy of W. Atlee Burpee Company, Philadelphia

TITHONIA
Tithonia speciosa

ZINNIA
Zinnia elegans

—that is, of the male and female elements. When a pollen grain germinates on a stigma, it sends out a rootlike tube which enters the ovule by a minute orifice called the micropyle, and so fecundates the germ cell within the embryo sac. As a consequence the ovule grows into a seed; the ovary also becomes enlarged, and develops into a fruit. Cross-fertilization, or allogamy, would seem to be the rule in nature, for there are many plant adaptations which prevent or hinder self-pollination. Thus the male elements may ripen before the female (protandry); the converse may take place (protogyny); or cross-pollination may be rendered necessary by hetesostyly, or the production of anthers and styles of varying height in different individuals of the same species. By hercogamy self-pollination is made mechanically impossible, as the anther cannot come in contact with the stigma. See Kerner's *Natural History of Plants* (trans. Oliver, 1902); Henslow's *Origin of Floral Structures* (International Science Series, lxiv., 1888); Lubbock's *Wild Flowers in Relation to Insects* (1873); Charles Darwin's *Effects of Cross- and Self-Fertilization in the Vegetable Kingdom* (1878), and other treatises on plant-life. See BOTANY.

Flower, Benjamin Orange (1858–1918), American editor and author, born at Albion, Ill., and studied at Kentucky University. He edited the *American Sentinel* in his native town for several years, and, finally settling in Boston, Mass., established there *The Arena*, of which he was editor until 1896. He was then editor of periodicals in Chicago until 1904, when he resumed the editorship of the *Arena*. Among his books, principally on sociological themes, are *Civilization's Inferno* (1893), *The New Time: Essays on Social Problems* (1894), *The Century of Sir Thomas More* (1896), and *Persons, Places, and Ideas* (1896).

Flower, ELLIOTT (1863), American journalist and author, was born at Madison, Wis., and received his education at Phillips Academy, Andover, and with private tutors. He settled in Chicago, where he was editor of *The Rambler* for two years. From 1892 to 1893 he was night city editor of the Chicago *Tribune*, and from 1895–1899 a member of the Chicago *Evening Post* editorial staff, retiring from newspaper work in the latter year. He published *Policeman Flynn* (1902), *The Spoilsman* (1903), and *Slaves of Success* (1905), among other books.

Flower, ROSWELL PETTIBONE (1835–99), American financier, was born at Theresa, N. Y., and received a high-school education, working on the farm and in the village store. He removed to Watertown, N. Y., and in 1869 to New York city, meeting with success both in business and politics, and finally establishing a large banking concern. He gained the favor of Samuel J. Tilden, and was elected a Democratic member of Congress in 1880, 1888, and 1890. In 1891 he was elected governor of New York, serving until the end of 1894. He made considerable bequests to church and charity, and built and equipped the Flower Hospital in New York.

Flower, SIR WILLIAM HENRY (1831–99), English zoölogist and comparative anatomist, born at Stratford-on-Avon. After serving as surgeon at the Crimea (1854), he became successively surgeon on the staff of the Middlesex Hospital, London (1855), curator of the Hunterian Museum of the Royal College of Surgeons, England (1861), Hunterian professor (1869), and director of the Natural History Museum at South Kensington (1884). He was an expert craniologist, unsurpassed as a comparative anatomist, and had great experience as an organizer of museums. He was the author of *Introduction to Osteology of Mammalia* (1870), *Fashion in Deformity* (1881), and *The Horse* (1890).

Flowering Rush (*Butomus umbellatus*), a European plant, growing in stagnant or nearly stagnant water. It has long sword-shaped leaves, and bears at the summit of a long stalk an umbel of large reddish flowers.

Flower of Jove, a term which has been applied to several flowers, including the carnation, the generic name for which, Dianthus, is a Greek equivalent for the expression. It is now more commonly given to *Lychnis flos-Jovis*, an old-fashioned tomentose plant about eighteen inches high, which bears in summer a dense umbel of small reddish flowers.

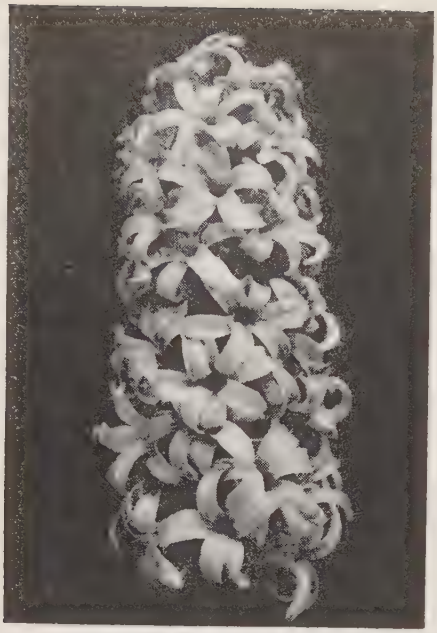
Flowers, ARTIFICIAL, are made for the purpose of ornamenting ladies' hats, bonnets, and dresses, although their use for other decorative purposes is greatly on the increase. France is the chief centre of their production; but in other parts of Europe and the U. S. large quantities are produced. The chief materials employed in their construction are cambric and other fine varieties of muslin, satin, velvet, small feathers, crape, gauze, and various yarns and threads. The leaves are stamped from green taffeta, etc., and, with the petals and sepals, are fitted to the required shape. Buds are made of taffeta stuffed with cotton wool, and the stalks of wire. Other materials employed in their manufacture are brown glass, brass, and mother-of-pearl.

Floyd, JOHN BUCHANAN (1807–63), American politician and soldier, born at Blacksburg,

Flowering Rush.
1. Flower, section; 2, fruit.

Va. He graduated at the College of South Carolina in 1826, became prominent as a laywer, practising in Ark. in 1836–9 and then returning to Va. In politics a States Rights Democrat, he served for several terms in the state legislature, was governor of Va. (1849–52), and in 1857 became secretary of war in the cabinet of Pres. Buchanan. In this position he was characterized by an 'utter incapacity for the proper and systematic transaction of business' (Rhodes), and late in 1860, on account of certain 'irregular and apparently corrupt financial transactions with some unscrupulous contractors,' he was asked by Pres. Buchanan to resign. Soon afterwards he resigned on the ground that Buchanan in failing to withdraw the Federal garrison from Charleston Harbor had violated his pledges to South Carolina. His administration of his department has given rise to much controversy, but it does not appear that he was personally corrupt, or that he himself profited in any way, or that he was deliberately and intentionally dishonest in his dealings with the contractors. In addition, however, he was

TULIP
Tulipa gesneriana



HYACINTH ENCHANTRESS
Hyacinthus orientalis

LEMON DAY LILY
Hemerocallis flava

CALIFORNIA POPPY
Eschscholtzia californica

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charged, and apparently with justice, with having taken advantage of his position to send large supplies of arms to the South in an anticipation of war. Prior to Lincoln's election, and, according to Buchanan and J. S. Black, prior to receiving the request for his resignation, he was 'an avowed and consistent opponent of secession' (Buchanan); but on the outbreak of the Civil War, he became a brigadier-general in the Confederate service. He was in command of Fort Donelson in Feb., 1862, but when surrender seemed inevitable relinquished his command and escaped from the fort. (See DONELSON, FORT.) Soon afterwards he was removed from command by Pres. Davis.

Floyd, WILLIAM (1734–1821), American patriot, a signer of the Declaration of Independence, born at Brookhaven, N. Y. He was prominent as a leader of the Whigs or Patriots in N. Y. before and during the Revolutionary War, was a member of the Continental Congress (1774–7 and 1778–83), and though his instructions prevented him from voting for the Declaration of Independence on July 4, 1776, he signed that document on Aug. 2. He was also for several terms a member of the N. Y. Senate, was a representative in the first Congress (1789–91), after the adoption of the Federal Constitution, and was a member of the State Constitutional Convention in 1801. See Sanderson's *Biography of the Signers of the Declaration of Independence* (1828).

Flucan is a Cornish miner's term, used to signify the soft earthy clay often found to occupy part of a mineral vein. It has been produced by the action of subterranean water circulating through the fissure decomposing the wall rock and the minerals of the vein. In part also it may be due to the friction of the walls of the vein on one another during periods of movement, grinding down the fragments of vein stuff and the faces of the walls themselves. Clay selvage is an equivalent term, and this same soft matter is sometimes called 'talc' by western miners.

Fludd or **Flud,** ROBERT (1574–1637), English physician and Rosicrucian, born at Bearstead, Kent. After studying chemistry in Italy, where he devoted himself to the works of Paracelsus, he became a practising physician in London. His fame rests, however, on his writings, wherein he advocated a system affirming the identity of physical and spiritual truth. One development of this was 'mystical faith-healing,' another a kind of dualism in therapeutics as well as in religion, whereby sickness and healing were produced and secured by two antagonistic powers. His system called forth replies from Mersenne, Kepler, Gassendi, and others. De Quincey writes of him as a father of Freemasonry. His principal works are *Clavis Philosophiæ et Alchymiæ Fluddianæ* (1633); *Utriusque Cosmi Minoris et Majoris Technica Historia* (1617–21); *Philosophia Sacra* (1626); *Medicina Catholica* (1629–31); *Integrum Morborum Mysterium* (1631). See De Quincey's *Works*, vol. xvi., p. 406.

Flüelen, vil. at s. extremity of the Lake of Lucerne, in the Swiss canton of Uri. It is the port of Altdorf (2 m. to the s.), the cap. of that canton. Pop. 941.

Flügel, JOHANN GOTTFRIED (1788–1855), German linguist and lexicographer, born at Barby, near Magdeburg. He first devoted himself to commerce, and emigrated to the U. S. in 1810, where he lived for ten years. There he studied English, and on returning to Germany was appointed professor of English in Leipzig (1824). He was appointed U. S. consul at Leipzig in 1838, and for some years after was connected with various literary and scientific institutions of the U. S. as German representative and correspondent. His life-work was his *Universal English - German and German-English Dictionary* (1830; 4th ed. 1891), which has become a standard work. He also wrote *A Series of Commercial Letters* (9th ed. 1874), *Praktisches Handbuch der englischen Handelskorrespondenz* (9th ed. (1873), and, along with his son Felix, *Praktisches Wörterbuch der englischen und deutschen Sprache* (15th ed. 1891).

Flügel Horn, a generic term applied by Germans to brass wind instruments of the bugle family, but in the British and German armies given more particularly to a B♭ cornet with pistons and a horn mouthpiece.

Fluid, the general name given to that form of matter which cannot resist permanently any shearing stress, however small. It does not possess elasticity of form. Consequently, when any distorting combination of forces acts upon a fluid, the fluid *flows* (hence the name), resisting while in motion the action of the forces in virtue of its viscosity, but not recovering its original form when the forces cease to act. Liquids and gases are the two types of fluid generally recognized. The branch of applied mathematics which treats of the motion and equilibrium of fluids is known as hydrodynamics; and the theoretically 'perfect fluid' is one in which there is no viscosity or fluid friction. Although in general there in no difficulty in distinguishing a fluid from a solid, it is not easy to state exactly when fluidity ceases and solidity begins. For example, lead, ice, shoemaker's wax, are regarded as solids. Yet lead can be made to flow through channels by applying suitable stresses. Glacier ice flows down valleys just like water, though at a much slower rate; and if a funnel or filler be filled with shoemaker's wax, the wax will, before long, be seen issuing from the lower end as a slowly flowing stream of matter. Cork and air bubbles will rise through a mass of shoemaker's wax, and lead will sink, just exactly as in water

Fluke. See NEMATODES.

Fluke. See LIVER-FLUKE and TREMATODES.

Fluorescence and **Phosphorescence** are two closely connected properties of certain substances. A fluorescing substance is one which rejects of throws back to the eye rays of light of a color or wave-length quite different from the color or wave-length of any of the rays originally falling upon it. Fluorescence was first observed by Sir John Herschel, but was first carefully studied, and its true nature discovered, by Sir George Stokes. Suppose a spectrum to be formed by passage of a ray of light through a prism and to be projected upon a screen of white paper, and let the unilluminated region immediately beyond the violet end be painted with a solution of sulphate of quinine: at once the whole region becomes illuminated with a violet light. Again, if the spectrum is thrown upon a strip of so-called canary or uranium glass, the blue and violet parts are changed into a brilliant greenish yellow, which is continued far into the ultra-violet region. In this case all rays, visible and invisible, of higher refrangibility than the green are transformed into green rays of the refrangibility corresponding to that color. In recent years the platino-cyanides of barium and calcium have come to the front as fluorescing substances. They fluoresce to the Röntgen rays as well as to ultra-violet rays, and are thus very valuable in certain surgical demonstrations.

A phosphorescent substance has the power of continuing to shine like a self-luminous body for some time after the removal of the incident light by which it was originally illuminated. The diamond has this power, as have also the sulphides of the alkaline earths. Becquerel, in his elaborate study of this phenomenon, found that many substances were phosphorescent for

a short but measurable time after the illuminating rays were cut off, so that the property was a much more general one than had been at first imagined. As a rule, the phosphorescent light, like fluorescent light, is of longer wave-length than the light which has stimulated the phosphorescence.

Dynamically, as was clearly pointed out by Stokes, phosphorescence and fluorescence are the same phenomenon, the one difference being in the longer duration of the former. Fluorescence ceases when the incident radiation is withdrawn; phosphorescence continues for a longer or shorter time. To paraphrase Stokes's own words, the incident vibrations cause an agitation among the ultimate molecules of the body, and these act as centres of disturbance to the surrounding ether, the disturbance lasting for a time which, whether it be long enough to be rendered sensible in observation or not, is at any rate long compared with the vibration of a single luminous vibration. Stokes has also given dynamical reasons for the fact that the change in refrangibility is always towards the longer wave-length. It may be described as a case of degradation of energy, the molecules absorbing the more rapid vibrations, and giving them forth again with a longer period. See Stokes's *Burnett Lectures on Light* (1884–7), and Tait's *Light* (3d ed. 1900, pp. 176–178).

Fluorescin $(OC(C_6H_3(OH)_2)_2 OC_6H_4CO)$ is a dye prepared by heating phthalic anhydride with resorcin. It is a brown powder that dissolves in water to form a solution with a beautiful green fluorescence; it has a certain, though very fugitive, dyeing power.

Fluorine (F 19) is an element of the halogen group, occurring chiefly in fluor spar or calcium fluoride (CaF_2), cryolite (Na_3AlF_6), and some other minerals. Though it has long been known to exist in combination, it was only isolated as recently as 1886 by Moissan, owing to its very active properties. The method employed is that of electrolyzing a solution of potassium hydrogen fluoride in anhydrous liquid hydrogen fluoride, fluorine being set free at the anode, and hydrogen at the cathode. The apparatus consists of a platinum, or more recently a copper U-tube to contain the solution; the current from twenty cells is led in and out of the liquid by club-shaped iridio-platinium electrodes fixed gas-tight in both limbs by fluor spar stoppers. Extreme precautions have to be taken to ensure that the apparatus and materials are perfectly dry, and the whole is cooled to −40° C. to lessen corrosion. The gas is led off to platinum vessels with fluor spar windows for examination.

Fluorine is a pale yellow gas that condenses to a yellow liquid at −187° C., and freezes at −223° C. to a white solid. Chemically, fluorine is most interesting from its intense activity; it unites directly, and with inflammation, with silicon, carbon, hydrogen, and almost all other elements, even in the dark. It acts instantly on water, displacing ozone; and it decomposes almost all compounds, usually uniting with the components to form fluorides, except in the case of oxygen, with which it forms no compounds. Of the fluorides, that of hydrogen (hydrofluoric acid, HF) is the most important. It is prepared by heating calcium fluoride with sulphuric acid, or, better, by heating potassium hydrogen fluoride. It is a colorless liquid, boiling at 19° to an intensely irritating acid gas that is soluble in water in any proportion. Hydrogen fluoride is useful mainly for etching glass. Calcium fluoride is the most important of the metallic fluorides, and is an insoluble colorless crystalline solid that is used as a source of hydrogen fluoride and as a flux. Cryolite is employed as a solvent for aluminium oxide in the preparation of aluminium by electrolysis. See Moissan's *Le Fluor et ses Composés* (1900).

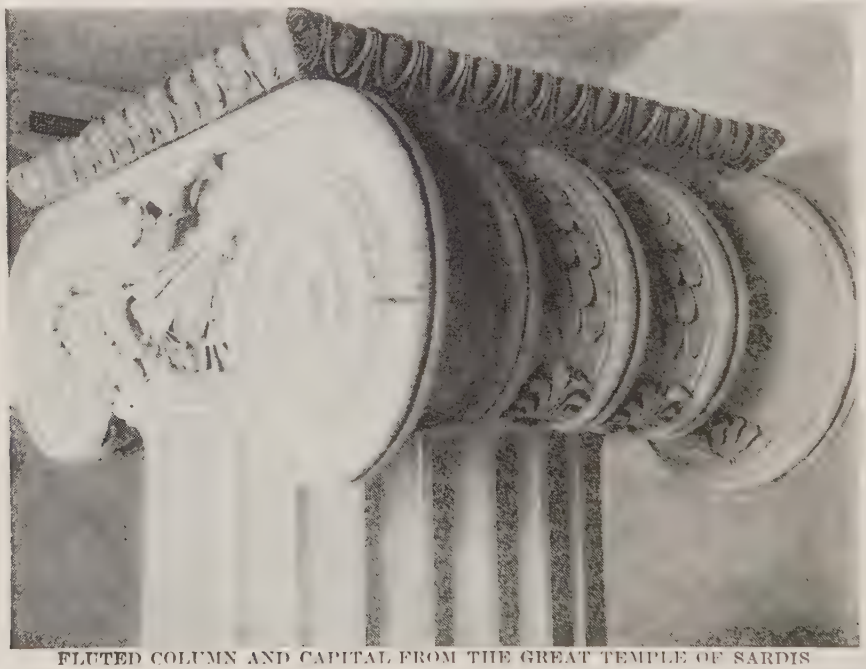
Fluor Spar, or FLUORITE, is a mineral consisting of calcium fluoride (CaF_2). It crystallizes in the cubic system (sp. gr. 3.1), and very perfect and beautifully formed crystals are common in many localities, especially in the lead mines of Alston Moor and other districts in the north of England. They may be colorless and perfectly transparent, in which case they are used, on account of their optical properties, in the manufacture of microscopic objectives and other refined optical instruments. More usually they are colored blue, purple, violet, yellow, brown, red, green, or other colors, and this mineral resembles the diamond and quartz in the great variety of tints it may assume. Sometimes the crystals show large, visible cavities, which contain a fluid and a mobile bubble; at other times they are turbid, on account of the presence of many minute enclosures. As fluor spar is comparatively soft (hardness—4, or somewhat harder than marble), it can easily be worked into ornaments, such as polished vases of blue fluor spar (known as blue john). It has a very perfect octahedral cleavage. The blue and green varieties, when exposed to the violet and ultra-violet rays of the spectrum, 'fluoresce' strongly. The color is discharged by strongly heating the crystals; hence it has been supposed to be due to the presence of volatile organic matters belonging to the hydro-carbon group.

Flushing (1.) In Dutch *Vlissingen*, fort. seapt. tn. of the Netherlands, prov. Zeeland, on the s. coast of the isl. of Walcheren—*i.e.* on the W. Scheldt. The existing harbor was constructed in 1865-73. In 1903, 756 ships of 638,970 tons entered and 750 with 633,306 tons cleared In 1809 the town was captured by the English. Shipbuilding is carried on. Flushing is also visited for its sea-bathing. Here De Ruyter was born. Pop. (1939) 22,554. (2.) Former village, Queens co., Long Island, N. Y., now included in New York city (borough of Queens). It is situated on Flushing Bay, an arm of the East River, and is an attractive residential place. The chief industries are the manufacture of tools, dyes, and glass, and market gardening. It is the seat of several educational institutions and an insane asylum. It was settled about 1645.

Flustra, a genus of Polyzoa, whose members are usually called sea-mats. In *F. foliacea*, commonly thrown up on North Atlantic beaches at all seasons of the year, the skeleton of the colony forms a flattened, lobed structure of yellowish-white color, often mistaken for sea-weed. A lens will show that each lobe is made up of a dense aggregation of minute cells, each of which in life lodges a zooid. Each zooid bears a crown of tentacles, which can be protruded from the cell. As each cell is furnished with a small lid, the animals are also capable of retiring completely within the cell, and closing the aperture behind them. The whole colony is fixed by its base to the sea-bottom or to shells, stones, etc., but is often torn off by storms.

Flute, a musical wind instrument consisting of a tube of wood or metal jointed in several parts, and open at the lower end. The air column of this tube is set in vibration by being blown into at or near to its upper end. The early Grecian form of flute had a conical bore, and had the lower termination of the tube widened out, as in a clarinet. The conical bore was also used in nearly all other varieties of the flute. The lower part of the tube contains a number of perforations which lengthen or shorten the vibrating column of air, according as they are closed or opened, and by this means different intervals of pitch are produced,

the instrument sounding its lowest note when all the perforations are closed. Six of these perforations are required in the side of the tube at correct distances above each other, in order to produce the notes which form a major scale. Blowing with an increase of force to the requisite degree causes the notes to sound one octave higher, and by a system of *cross-fingering* a third octave may be added. For the production of chromatic intervals additional perforations are made, which are manipulated by means of keys. The German flute (Fr. *flûte traversière*), invented about 1720, which superseded the *flûte à bec*, differs from preceding forms in being entirely closed at its upper extremity, and having an orifice —termed the embouchure—cut in the side of the tube at a short distance from its head. The inner surface of the tube is reduced at the orifice till its edges are quite thin, and the performer, while holding the tube sideways against the lower lip, by directing a current of air partially across and partially into the orifice, causes the instrument to sound. This method of tone production is that employed in all modern varieties of the flute proper. (See FIFE, PICCOLO.) Though the German flute was a great improvement upon older forms, the perforations in its tube had to be in such relations to one another to accommodate the exigencies of fingering that the instrument could be in tune only in certain keys, while some keys were much more difficult of manipulation than others. But a new method of construction and system of fingering were introduced into Great Britain by Boehm about 1834. Shortly after this Boehm discovered that a cylindrical bore produces a broader tone of a much more reedy quality than that obtained from a conical bore; and with the exception of a short parabolic section, which forms the upper termination of the instrument, the cylindrical bore is a distinctive feature in all Boehm flutes. Nearly all concert flutes now in use are constructed upon the Boehm system, or modifications of it. Cocoa-wood is the material most frequently employed in the manufacture of flutes, but gold, silver, and other metals are also used. In the orchestra the flute still holds a highly important position; but as a solo instrument it is less frequently heard now than it was formerly.



FLUTED COLUMN AND CAPITAL FROM THE GREAT TEMPLE OF SARDIS

Flute-mouths, fishes of the Fistularidæ family.

Fluting, the channelled surface of the shaft of a column. It is composed of a series of upright concave grooves, and a corresponding number of vertical edges, as in the Doric order; in the other orders the arris or edge is pared off, and what is known as a 'fillet' formed. The classic examples are the Doric, containing twenty flutes round its circumference. These rise from the pavement, and are intercepted by the horizontal bands of the echinus at the point where the capital spreads out. The Ionic, Corinthian, and Composite have twenty-four flutes, which terminate hemispherically at the base and upper portion of the shaft. There are various forms of decorated fluting. (See COLUMN.)

Fluxes are those substances which are used in the smelting of metals to increase the fluidity of the acting materials, and thus to allow them to come into more intimate contact, to enable the separated metal to settle more easily, and to dissolve earthy impurities. The term is also used to denote those agents employed to prevent the oxidation of or clean the surfaces of metals that are to be joined by welding or soldering. Thus, sand is sometimes employed in the welding of iron or steel; borax is used for silver soldering or brazing; rosin, chloride of zinc, or sal ammoniac for soft soldering tinned iron, copper, or brass. Rosin should be used for all soldered joints for electrical purposes.

Fly. See DIPTERA; HOUSEFLY; GNAT, etc. For artificial flies, see articles under the heading ANGLING.

Fly, largest river of New Guinea; rises in the N.W. part of British territory, and enters the Gulf of Papua by a delta. It has a course of over 600 m. from the British-German boundary, and is navigable for 500 m.

Fly-blister. See CANTHARIDES.

Fly-catcher, a name applied

to two families of passerine birds: the *Muscicapidæ*, or true fly-catchers, which are exclusively Old World forms, and the *Tyrannidæ*, or American fly-catchers.

The true fly-catchers include over 700 species, usually frequenting open woodlands, orchards, and gardens. They are mostly of small size, with long, pointed wings, relatively long tail, often graduated, and strong, short, and somewhat swallow-like bill. The prevailing colors are shades of brown and blue and olive green, varied with black, white, and yellow. These birds are almost wholly insectivorous, perching for a long time in one spot, and darting at passing insects, which they seize with a snap of the bill. Typical of the Muscicapidæ are the Spotted Fly-Catcher (*Muscicapa grisola*), a tiny brownish-grey bird with a monotonous chirp, common throughout Europe, and found in England in spring and summer; the European Pied Fly-Catchers (*M. atricapilla*); the White-Collared Fly-Catcher (*M. collaris*) of Central and Southern Europe; the Red-Breasted Fly-Catcher (*M. parva*); the Narcissus Fly-Catcher (*Xanthropygia narcissina*) of China and Japan, brilliantly marked with yellow and orange; the Paradise Fly-Catchers (*Terpsiphone*), of which there are about twenty-five species in Africa and Southern Asia, characterized by great elongation of the two central tail feathers; and the Fan-Tailed Fly-Catchers (*Rhipidura*), of which there are about one hundred species, native to the Malay Archipelago.

American fly-catchers, or Tyrant Birds, are small, dull-plumaged birds feeding on insects in much the same manner as the Old World species. They include the Kingbird, Crested Fly-Catcher, Phœbe, Olive-Sided Fly-Catcher, Wood Pewee, Yellow-Bellied Fly-Catcher, Acadian Fly-Catcher, Traill's Fly-Catcher, and Least Fly-Catcher or Chebec. See TYRANT BIRDS; KINGBIRD; PEWEE.

Fly-fishing. See ANGLING.

Flygare-Carlén. See CARLÉN.

Flying. See FLIGHT; AERONAUTICS; FLYING MACHINES.

Flying Animals, in the strict sense of the term, comprise only winged insects, birds, and bats; but certain fish, reptiles, and amphibians, and a number of mammals other than bats, have a limited power of flight, and may be included under this head.

Among fish two very distinct genera (*Exocœtus and Dactylopterus*) have the power of skimming for considerable distances above the surface of the water, their expanded pectoral fins forming a parachute (see FLYING FISH). Flying reptiles are exemplified by certain species of the lizard Draco, in which the skin is stretched on several elongated ribs so as to form a sort of half kite on either side (see DRACO; LIZARDS); by some varieties of Gecko (q.v.)—*e.g.*, the Californian *Phyllodactylus tuberculatus*—in which there is a membranous fringing of body, tail, and limbs; and by certain extinct reptiles (pterodactyls), in which the outer finger was enormously elongated, and supported a wing-like expansion of the skin. In several ways these extinct forms were prophetic of birds, and certainly must be said to have had wings; though what progress they were able to make in the air is not known (see PTERODACTYLS). Among amphibians is the Flying Frog or Tree Frog (*Rhacophorus*), whose long toes are joined by membranes enabling it to make sailing leaps from tree to tree (see FROGS).

It is among mammals, however, that attempts at parachute flight are most frequent, occurring not only in bats (q.v.), but in certain marsupials, such as the Flying Phalanger (q.v.); some species of rodents, as the Flying Squirrel (q.v.); and some insectivores, of which the Galeopithecus (q.v.) or Flying Lemur is characteristic.

Flying Boat. See FLYING MACHINES.

Flying Buttress. See BUTTRESS.

Flying Column, a military term, denoting a small but complete body of troops, including infantry, cavalry, and sometimes horse artillery, equipped with its own supplies. It is organized for rapid movement from place to place, independent of any particular base of operations, and is used, as a rule, for some special purpose—as to relieve a garrison, capture a stategic point, or harass the forces of the enemy. A flying column organized under General (later Earl) Roberts (q.v.), during the Afghan War (1879), covered a distance of 300 miles in 21 days, and routed the enemy at the end of a long and difficult march.

Flying Dutchman, the apparition of a Dutch vessel, said to be encountered off the Cape of Good Hope, and regarded as a portent of evil. Legend relates that a Dutch captain, Van Straaten, was condemned, for murder or blasphemy, to beat up against the storms of the Cape until Doomsday, without reaching heaven. Seamen who saw his black, spectral ship on the horizon quickly changed their course, and hastened to flee from his fatal influence. The notion that gave foundation to this legend is widespread in German mythology. The same story is localized in the German Ocean, where Herr von Falkenberg is condemned to beat about the ocean until the day of judgment, on board a ship without helm or steersman, playing at dice with the devil for his soul. In the form of the legend chiefly current in England, the impious seaman's name is Vanderdecken.

Wagner's opera *Der Fliegende Holländer;* Fitzbald's drama, *The Flying Dutchman* (in both of which the luckless captain's name is 'Vanderdecken'), and Marryat's novel, *The Phantom Ship*, are all founded on the legend.

Flying Fish, a name applied to certain bony fish of the genera *Exocœtus and Dactylopterus*, which, by virtue of an elongation of the rays of the pectoral fins and an extension of the inter-

Flying Fish

radial membrane, are capable of flight or sustentation in the air.

The flying fish proper (*Exocœtus*), of which more than forty species are known, occurs in shoals, chiefly in the warmer seas. It is characterized by the great length of the pectoral fins and the blunt, short-jawed head. Its average length is about one foot. Lifting itself from the water by a vigorous movement of the tail and caudal fin, it keeps the pectoral fins extended like a parachute during flight, such vibration as takes place being due to the action of the air currents on the tense elastic membrane. The extent of the flight is ordinarily from 30 to 50 yards, lasting less than 20 seconds; but this distance may be increased by the fish's dipping into the sea and obtaining augmented propulsion. The course is parabolic, like that of a projectile, and is usually close to the water; but it may be modified by air currents, which sometimes lift the fish over high waves, or cast them on the decks of ships. They are said to fly most frequently in stormy weather, and farthest against the wind.

Of the *Dactylopterus*, or Flying Gurnard, sometimes known as the Sea Bat or Flying Robin, three species occur—in the Mediterranean, the tropical Atlantic, and the Indo-Pacific Ocean. They measure from 12 to 18 inches, are more heavily built than the true flying fish, and are covered with keeled scales. The pectoral fins

have a wing-like form, being divided into a small anterior and large posterior part.

Flying Fox. See FRUIT BAT.

Flying Frog. See FROGS.

Flying Gurnard. See GURNARD.

Flying Jib. See JIB.

Flying Machines. Flying machines are those types of aircraft, heavier than the air they displace, which are supported by the dynamic action of the air, rather than by gaseous fluids, lighter than air, as are balloons (q.v.). The term, while passing into disuse, includes all heavier-than-air aircraft, whether mechanically driven, or without a power plant.

The treatment of material under this heading is primarily from a historical point of view, with no attempt made at detail or in delving into the latest developments in aviation and aircraft, the types of aircraft, the commercial and civil aspects, or the military and naval aspects. All this is treated in great detail under the heading AERONAUTICS. More specific treatment is also to be found under these separate listings: AERIAL PHOTOGRAPHY; AERODYNAMICS; AIRPOCKET; AIRSICKNESS; AIR LAW; AIR RAIDS; DIRIGIBLE; ZEPPELIN.

Mechanically driven aircraft, heavier-than-air, may be divided into three types—airplanes, helicopters, and ornithopters.

Airplane is the accepted name for any mechanically driven aircraft, heavier than air, fitted with fixed wings, and supported by the dynamic action of the air. It has a fuselage or body, where pilot, passengers and cargo are carried, and to which the wings and control surfaces are attached; a power plant driving one or more propellers, to propel the craft through the air, and landing gear, equipped with wheels, floats or skis for taking off from land, water, or ice. There are a number of types of airplanes, distinguished as *tractors* when the propeller or propellers are in front of the main supporting surfaces, and *pushers* when the propeller or propellers are in the rear of the main supporting surfaces. In some cases both tractor and pusher propellers are used on the same machine.

Airplanes are classified by the arrangement of their main supporting surfaces as *monoplanes*, which have one main supporting surface, sometimes divided into two parts by the fuselage; *biplanes*, which have two main supporting surfaces placed one above another; *triplanes* and *quadruplanes*. *Sesquiplanes* are properly biplanes, but are so designated because of the small size of the lower wing. *Tandem airplanes* have two or more sets of wings of substantially the same area (not including the tail unit) placed one in front of the other and on about the same level. *Multiplanes*, while properly embracing airplanes having two or more main supporting surfaces, are usually understood to be airplanes with multiple wings, as in the case of early experimental types.

Landplanes are airplanes designed to rise from and alight on the land. Seaplanes are airplanes designed to rise from and alight on the water. This general term applies to both boat and float types, though the boat type is usually designated as a 'flying boat.'

Helicopters are those aircraft whose sole support in the air is derived directly from the vertical component of the thrust produced by rotating airfoils. Meagre success has been achieved by this type, none of which has passed beyond the experimental stage.

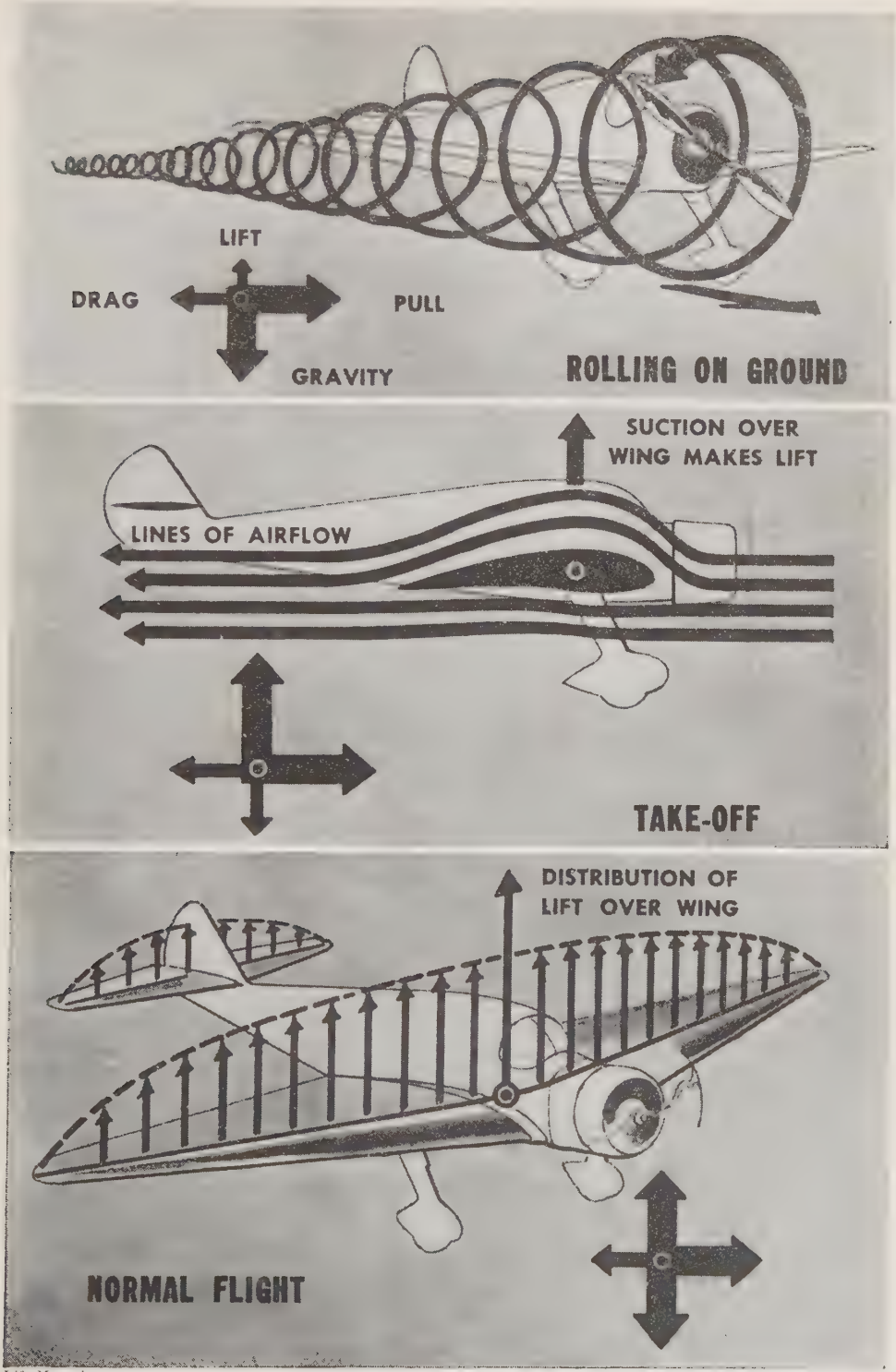
Ornithopters are aircraft heavier than air, like birds, deriving their chief support and propelling force from flapping wings. No success has been attained by this type.

Powerless flying machines include kites, which are heavier-than-air craft restrained by a towline and sustained by the relative wind, and gliders, which are similar to airplanes, but contain no power plant.

Principles of the Airplane.—The theory of the airplane is essentially that of the flying kite or the sail boat. The force of the wind acting in a surface obliquely is resolved into two components. In the sail boat, one component tends to capsize the craft, and must be resisted by stable design and ballast, while the other tends to push it forward; in the flying kite, one component acts in a vertical direction, and the other against the pull of the string. In the case of the airplane a wind blowing from beneath a plane would act to overturn it were not its stability maintained by its construction or balancing. Likewise, it would drive the plane backward, as may be seen when a card is dropped in a current of air and falls with its surface parallel with the ground. The airplane uses the air as a cushion which supports it for an instant, as the water supports a skipping stone. The airplane, driven forward by its propeller or propellers, passes on before the cushion of air gives way.

When the force of the moving air acts on the surfaces inclined at an angle to its direction, it is resolved into two components—one known as lift, a force which acts at right angles to the direction of the wind, and the other known as drag, which is in the general direction of the wind. In normal flight there is a positive pressure on the lower surface of the plane, and a negative pressure on the upper, due to the flow of air around the wing. Obviously, the intensity of the lift component must depend to some extent upon the density of the air, the power of the engine, and the thrust of the propeller. Speed is also more or less proportional to the weight of the machine and motor, as the more powerful the engine the greater the weight, under ordinary conditions. Consequently, the elemental problem is to adjust all these factors so as to obtain a machine of the greatest efficiency. Again the problem varies with the conditions of flight—whether maintained on a level, or rising, or sinking. In rising from the ground or in climbing to high altitudes the flying angle is larger and necessitates greater power than when the machine is on a level course. A larger measure is devoted to the lift component, and consequently the speed is decreased. On a down grade the conditions are reversed, and the speed is greater.

It will be apparent that two primary considerations are involved—namely, the supporting surfaces and the power plant. As in nature the wings of a bird are curved, so early airplane designers found that curving the wings or giving to them a camber would result in a saving of power. A curved or cambered wing is superior to a flat plane as it not only supports more weight, but affords less resistance to forward motion. The term span is usually applied to the width or extreme spread of wings, while their narrower dimension is referred to as the chord. Increasing the number of planes increases the supporting surface, but not to the same degree as it does head resistance. Unless the proportions of the gap to the chord are correct, the middle plane of a triplane does not give maximum lift, but becomes a parasite, causing resistance in excess of its lift, thereby cutting down the efficiency of the airplane. The amount and nature of the supporting surface depend upon the speed of motion, and therefore on the power of the propeller and engine. If a machine is designed to fly slowly it requires a larger surface than one with a powerful engine and a propeller capable of driving it at high speed. Below a certain minimum it is impossible



Life Magazine

HOW AN AIRPLANE FLIES

Flying Machines

for an airplane to rise, or even to support itself. With no power, however, if he maintains his equilibrium, it is possible for the aviator to glide or volplane in safety to the ground from a considerable height.

Given the supporting surfaces, the next consideration is to diminish the amount of head resistance. Accordingly, the central portion, carrying the pilot and power plant, has been reduced in recent designs, and is now usually enclosed in a car or fuselage—resembling the body of a bird or fish—so as to offe minimum resistance to the air. To cut down the stream-line resistance the fuselage is enclosed, varnished, and finished smooth.

All of the various factors connected with the airplane are susceptible of mathematical analysis, and so far as data are available to the aviator or the designer of airplanes, he is able to work with considerable accuracy. His work, however, is handicapped by the fact that the atmospheric conditions are in no way constant, and are at best little understood.

The importance of research in the development of sound engineering practice has nowhere been so well understood as in the field of aircraft construction, and much effort and money are being devoted by governmental and private agencies to the provision of proper laboratory facilities. High-speed and variable-pressure wind tunnels capable of testing the efficiency of large scale models of airplanes have resulted in important improvements in design and construction.

The use of the light alloys of aluminum, and of high tensile-strength steels has made it possible to construct airplanes whose useful load approximates 50 per cent of their gross weight. The improvement in construction methods, and the design of more efficient wing-sections have aided in this advance, and made the airplane an economical vehicle for the transportation of passengers, mail and express.

Engines.—In general, airplane engines are of two kinds: air-cooled and water-cooled. Water-cooling by the circulation of water through jackets around and over the cylinders is efficient, and permits the use of a cylinder arrangement which reduces frontal area and head resistance. It has the disadvantage of requiring a radiator, with piping and circulating pump, and the increased weight entailed by these and the contained water. In the air-cooled engine, the tops and sides of the cylinders are provided with thin flanges, or fins, against which air is blown by the propeller, or by the forward motion of the airplane.

The object of engineers has been the reduction in the ratio between the unit of weight of the engine (which is the pound) and the unit of power developed (which is the horsepower). In 1915 the ratio for water-cooled engines was four pounds to one horsepower; for air-cooled engines, three pounds to one horsepower. Recent developments have cut this ratio by half, so that the ratio for water-cooled engines is now two pounds to one horsepower, and for air-cooled engines, one and one-half pounds to one horsepower.

Airplane engines are also classified by the arrangement of their cylinders. The number of cylinders depends principally upon the power of the engine, although to a less degree on the type. In very small engines, as few as two or three cylinders may be used, but where it becomes necessary to avoid vibration, as in medium and large sizes, the number of cylinders is increased, and they are so arranged as to balance each other.

The different types of engines are classified according to the arrangement of the cylinders. These are as follows:

VERTICAL ENGINE. — An engine having its cylinders arranged vertically above or below the crankshaft, in a single row.

V ENGINE.—An engine having its cylinders arranged in two rows, in the form of the letter V, both rows of cylinders being connected to the same crankshaft.

W ENGINE.—An engine having its cylinders arranged in three rows, all connected to the same crankshaft; the three rows of cylinders, when viewed from the front, forming a figure similar to the letter W.

X ENGINE.—An engine having four rows of cylinders, in the form of the letter X when viewed from the front, and all connected to the same crankshaft.

FLAT ENGINE. — An engine having cylinders arranged in two horizontal rows on opposite sides of the crankshaft.

INVERTED ENGINE.—An engine of the vertical V or W type, having its cylinders hung below the crankshaft.

RADIAL ENGINE. — An engine having stationary cylinders arranged radially, like the spokes of a wheel, around the crankshaft. The usual type is a single-row radial, but radial engines may be made in more than one row, each behind the other.

ROTARY ENGINE.—An engine, usually of the radial type, in which the cylinders and crankcase revolve about a stationary crankshaft.

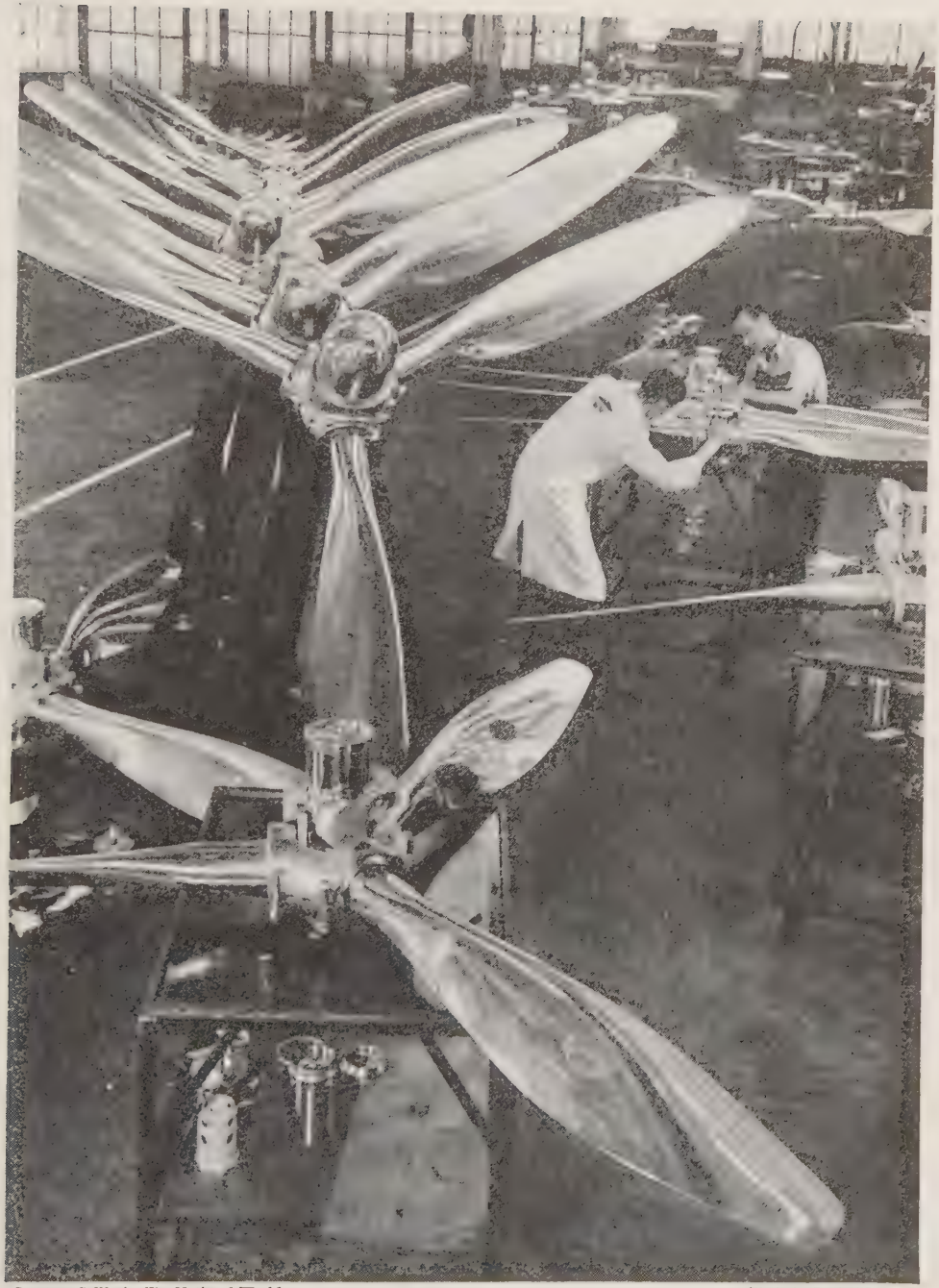
BARREL ENGINE. — An engine having its cylinders arranged around the crankshaft with their axes parallel to the shaft. This type is not in practical use.

Seaplanes.—In general, a seaplane is an airplane designed to arise from and alight on the water. Three distinct types exist: the float type, in which a pontoon or float is attached to the fuselage by struts; the boat type, in which the fuselage itself is transformed into a boatlike hull, which serves as a shelter for the passengers and furnishes the buoyancy required to support the airplane on the water; and the amphibians, which may be either of these two types with the addition of a retractable landing gear, permitting the airplane to take off and land on land or water. These airplanes are not nearly as efficient as land airplanes, because the resistance of the floats to the air results in less speed per horsepower developed as compared to land craft.

In the float type of seaplane, three types of construction are used: central pontoon, two pontoons, three pontoons. The first of these, with a long central pontoon and several smaller ones on each wing to maintain equilibrium in the water, is no longer used. The second one consists of two long, lateral pontoons. The third consists of two long lateral pontoons, and a third one below the tail.

In the boat type of seaplane, the hull takes the place of the fuselage found in the float type of craft. The shape of the hull, which slopes upward sharply in front, tends to lift the craft bodily in the water as speed is increased. The consequent reduction in the wetted area, and in the skin friction, permits the attainment of even greater speed, until the lift of the wings is able to take the machine into the air.

Propellers. — These were at first made of wood, and were two-bladed. Because wood was not completely satisfactory, experiments led to the use of metal for this purpose. The earliest of these was a twisted plate of duralumin with a built-up wooden hub attached to the blade by bolts; a later development was a forged propeller in which hub and blades were forged from a single piece of duralumin; and from this, in turn, was developed a detachable blade propeller, in which the blades are forged from duralumin, with shouldered butts held in a two-piece steel hub by heavy bolts, the hub be-



Courtesy Collier's, The National Weekly — Photo by Dmitri Kessel

AIRPLANE PROPELLERS ARE INTRICATE MECHANISMS

The assembly line in a large propeller factory showing workmen checking new constant-speed variable-pitch three-bladed propellers.

Flying Machines

ing machined to fit the engine shaft. This last type had the advantage of permitting adjustment of the pitch. A recent development is a three-bladed propeller made of aluminum and steel alloys.

Wings.—The wing framework was at first covered by stretched cotton cloth. The fabric covering was held in place by stitching with heavy thread, and then shrunk to the required degree of tautness by painting with a cellulose derivative which filled the interstices of the cloth, and stretched it to form a smooth, tight surface. Spars made of wood cut from single pieces of spruce were used for the construction of the wing framework. Wooden spars have given way to metal spars; and fabric covering for the wings has given way to metal covering.

Fuselage. — The fuselage is that part of the airplane which supports the engine and propeller, houses the pilot, passengers, and cargo, and carries the control surfaces. In commercial passenger types it is identified as the cabin. In the early days wood and wire were used to construct the rigid framework for the fuselage, which then was covered with fabric or a veneer. In seaplanes the hulls were constructed of wood, and the pontoons were made of laminated wood. Wood has given way to metal in the construction of hulls and pontoons, and steel or duralumin tubing, welded or riveted, has replaced wood in fuselage construction.

Landing gear.—In the earlier airplanes the landing gear consisted of two wheels, with or without a cross-axle, made of wire spokes, on which were pneumatic cord tires; and a tail-skid of the sliding type. The tail-skid has now given way to a small wheel in the rear of the machine, and wire wheels have been replaced by small disc wheels on which are very large balloon tires, containing air at extremely low pressure. Another feature of modern aircraft is the retractable landing gear, by means of which the wheels are drawn up flush with the wings once the airplane has left the ground. On still other of the newer planes there is a recess within the wings into which the wheels are drawn, so that no part of the landing gear is visible while the airplane is in flight. This serves to eliminate the resistance of the landing gear to the air and adds greatly to the power and efficiency derived from the engine. Almost all commercial air liners, as well as military and naval planes, now use this device.

Pilots. — The international agency for the supervision of airplane competitions and the homologation of records is the Federation Aeronautique Internationale, founded in October, 1905, with headquarters in Paris. Its American representative is the National Aeronautic Association, which superseded the earlier Aero Club of America. While the F. A. I. continues to license pilots for sporting events, the examination and licensing of pilots for commercial aviation have become a function of Federal governments in all large countries. In the United States, by the Air Commerce Act of 1926, this power was vested in the Secretary of Commerce, who administers it through the Aeronautics Branch of the Department of Commerce. The requirements for licensing are strict, and licenses are issued in categories as follows:—Private, Limited Commercial, and Transport.

Many States in the United States require State examination and licensing of airplane pilots operating within their borders.

Operating.—The operation of an airplane requires considerable skill, but is within the capability of any person, with normal vision and in good physical condition who possesses ordinary manual dexterity and has no nervous disorders. Courses of instruction include a 'ground course' in the theory of flight, and in engine operation and maintenance, followed by a period of dual instruction of about ten to twenty hours of flight with a qualified pilot, after which the student is permitted to make 'solo' flights until practice has made him proficient. Military fliers are required to undergo lengthy training in navigation, gunnery, bombing, and other military branches before they are brevetted as pilots. Commercial pilots are required to demonstrate their proficiency before licenses are issued by the appropriate governmental agency, and are examined periodically to insure their physical well-being and their skill.

Taking off and landing require the exercise of skill and judgment in a greater degree than straight flying, which becomes almost instinctive in the experienced pilot. Air navigation on long flights is conducted in a manner very similar to ocean navigation, although special instruments are required, and allowance must be made for the drift of the airplane in cross-winds.

Historical.—Human flight is the realization of our ancestors' remotest imaginings. The wish to imitate birds and rise freely in the air is possibly as old as intellect itself. The first mention of human flight occurs in Ovid, and is part of Greek mythology. We are all familiar with the fable: Dædalus (q.v.) and his son, Icarus, flew from the wrath of King Minos by means of artificial wings, the unlucky Icarus soared too high, the sun melted the wax with which his wings were fastened and he fell into the sea. In Indian mythology Hanouman, on the advice of the sage Jambarata, fitted himself with wings, sailed in the air, and landed, as he had wished, in the sacred Lauka. In Babylonian lore Etana, the strong one, flew on an eagle to the several heavens, up to the sun god and to the sky of the planets, seeking the magic herb of birth. In Peruvian myth the chieftain Ayar Utso grew wings and flew and visited the sun; in Germanic lore Wieland, the smith, made himself a 'wing dress' with which he rose and descended against the wind.

Stanley in his 'Through the Dark Continent' mentions a legend of the negroes of the region northwest of the Victoria Lakes, according to which an African flying warrior named Kibago antedated by some centuries the Italians who threw aerial bombs on the Turkish forces in 1911. This warrior went aloft with loads of rocks, and not only scouted the enemy, but also hurled rocks into their ranks, killing hundreds. In 'Relationum Historica de Rebus Anglicis' it is recorded that Bladud, ninth king of Britannia, after performing a number of feats of wizardry, adopted wings and attempted to fly, but fell and broke his neck.

There are historical records of attempts to fly in the earliest days of our era. As early as four hundred years before Christ a Pythagorean philosopher named Archytas, of Tarantum, constructed a wooden mechanical bird, which, according to report, made a flight. A number of other attempts to fly in early historic times have been recorded, but for many centuries such attempts were considered sacrilegious, and those who indulged in them were prosecuted, as witness the following account of 'Simon the Magician,' who attempted the flight in the year 66 A.D.

'Simon the Magician—who called himself the mechanician—made certain experiments at Rome of flying a certain height. In the eyes of the early Christians this power was attributed to the devil, and St. Peter, the namesake of this flying man, is said to have prayed fervently while Simon was amusing himself in space. It was possibly in answer to his prayers that the magician failed in his flight, fell upon the Forum, and broke his neck on the spot.'

Flying Machines

In the thirteenth century the English friar, Roger Bacon, said that there could be made 'some flying instrument, so that a man sitting in the middle of the instrument and turning some mechanism, may put in motion some artificial wings which may beat the air like a bird flying.' But to avoid the charge of practising necromancy, which such an admission might have brought, he warily added: 'Not that I ever knew a man that had such an instrument, but I am particularly acquainted with the man who contrived one.'

Jean Baptiste Dante, a mathematician of the fifteenth century, who tried to fly with artificial wings, met with the same fate as his predecessor, Simon. After attaining some success in secret experiments, he made the matter public, and offered to exhibit the wonder of his wings to his townsfolk at a town festival. Some well-meaning spirit again interposed with prayers and Dante's wings failed him and he fell upon the church. At about the same time, an astronomer named Jean Muller repeated the feat of Archytas of old, constructing several mechanical birds, one of which is reported as having made a glide in the presence of Emperor Frederick IV. Soon after, early in the sixteenth century, Leonardo da Vinci, the celebrated painter-sculptor-architect-engineer, proposed human flight by means of wings built on the principle of bird wings. Sketches are still in existence showing that his proposal was *bona fide*, but no experiments were made. Another attempt to fly with feather wings was made in Scotland in 1510 by an Italian friar. He fashioned a pair of wings, and made the attempt in the presence of King James and his court at Stirling Castle, but it was a complete failure. The wings failed to support him and he fell from the height of the battlement from which he had launched himself onto a manure heap, breaking his thigh bone.

A century later, in 1617, another English monk made himself wings, with which he tried to fly at Tübingen, but with fatal result. Two attempts to glide by wing-like devices were made in France in the seventeenth century—the first by a tight-rope performer named Allard, in 1600; the second by a blacksmith named Besnier, in 1678. In both cases the glides were more or less acrobatic feats, made after long practice. Later (1742) a Marquis de Bacquerville made another attempt. With wings secured to his arms and feet, he launched himself into space from a window of his mansion on the river Seine, but the wings did not have enough sustaining capacity to carry him as far as the water.

The idea that an aircraft might be navigated in the air by means of flapping wings was ever prevalent, and a number of attempts in that line were made. The results were discouraging. In 1772 the French canon, Abbé Desforges, constructed a flying machine, or winged chariot, fitted with sails, which he expected to navigate in the air, obtaining the lifting power by a rapid movement of the wings. Needless to say, it did not work.

A number of treatises on human flight were written at different periods, but for the most part these dealt with the fantastic. A Neapolitan physician named Borelli, in a scholarly study of bird flight, discussed the possibilities of human flight by means of wings; and in two treatises published in the latter part of the seventeenth century, an eminent English ecclesiastic, John Wilkins, Bishop of Chester, discussed the possibilities of human flight by different means.

From the foregoing it will be seen that none of the experimenters before the seventeenth century succeeded in evolving a theory or method of scientific value. That was still true, as far as power flight is concerned, at the beginning of the nineteenth century. During that century history has a list of some two-score of experimenters who tried to develop power flight.

Sir George Cayley (1809–1910), an English inventor, was the first to plan dynamic flight on a scientific basis. He planned an aeroplane built with slightly oblique planes, resting on a wheeled chassis, fitted with propellers, motors, and steering devices. Samuel Henson, another English inventor, in 1843, patented what was designated as an 'aerial steam carriage,' an aeroplane of immense size, which was to be used for passenger carrying. This carriage was never built. Another English scientist, F. H. Wendham, improved on Henson's idea, and in 1867 developed a multiplane. This model was taken up by J. Stringfellow, who reduced the number of planes to three, making a triplane, which he fitted with a tail and two propellers, and which he showed at the exhibition of the Aeronautical Society of Great Britain in 1868. While there was nothing in this model to indicate that the inventor had any comprehension of the principles of stability or knowledge of the lifting capacity of surfaces or of the power required for dynamic flight, Stringfellow deserves credit for building a very light motor, one of sufficient lightness, in fact, to support a well-designed airplane.

In 1872 a French inventor Alphonse Penaud, constructed a small monoplane. It was only a toy—two flimsy wings actuated by a twisting rubber—but it had fore-and-aft stability, something that most of the creations of the time lacked. Subsequently, in 1875, Penaud took out a patent on a monoplane fitted with two propellers and having controlling devices. But this was not built, principally because it would have required a light motor, and the lightest available at the time weighed over 60 pounds per horsepower, twenty times the weight of the motors of today.

Louis Pierre Mouillard, a Frenchman, having observed that large birds in flight, while seeming at rest, could go forward against the wind without a stroke of the wings, constructed a number of gliders, built on the principle of bird wings, and experimented with gliding. In 1881 he published a valuable work entitled 'L'empire de l'air,' which inspired many of the later experimenters. Subsequently he invented a soaring machine, which he patented in 1892.

These early experiments laid the foundation of modern aviation. They showed the supporting power of thin, rigid surfaces, defined the general shape and structure of airplanes, and prepared the way for the next generation, which was to perfect these, and find means to make the airplane rise from the ground and maintain equilibrium in the air.

This new generation, which came toward the close of the nineteenth century, was divided into two schools. The first sought to achieve soaring flight by means of large kite-like apparatus, which enabled them to soar in the air against winds, their machines being lifted up and supported by the inertia of the air as kites are. The second sought to develop power flight, that is, to send their kite-like machines through the air at high speed, being tracted or propelled by revolving screws actuated by motor power.

The most eminent experimenters in the first schools were Otto Lilienthal, who was the chief expounder of gliding flight; P. L. Pilcher, an English follower of Lilienthal; Octave Chanute, an American follower of Lilienthal, and J. J. Montgomery, also an American. Lilienthal, a German, was the first to make gliding flight a science, being the first also to define the value of arched wings, and to determine the amount of pressure to be obtained at various angles of

Flying Machines

incidence. He met with an untimely death while experimenting in 1896. Chanute's experiments were along the same line as those of Lilienthal, but his great contribution was his early encouragement of the Wrights, although it was not by adopting his theories that the Wrights attained success.

The leaders of the second school, who actually built and tried power-driven airplanes, were Clement Ader (1890–1897), Sir Hiram Stevans Maxim (1890–1894), and Samuel Pierpont Langley (1895–1903). Clement Ader was the first to construct an airplane large and powerful enough to carry a man. The French government considered the craft of immense value and employed him to build some for the army, but as each of the two experimental planes toppled over at the trial and were wrecked, the government refused further to finance the enterprise. While Ader was making his experiments in France, Sir Hiram Maxim was at work constructing a large multiplane for the English government, which he fitted with two steam engines of 175 horsepower. Like Ader's, it toppled over at the first trial and was badly damaged, and the British government refused further backing. The experience of Samuel Pierpont Langley in America is not unlike the experience of Ader in France and Maxim in England. He was employed by the Board of Ordnance and Fortification of the U. S. Army to construct the 'Aerodrome' of his own invention, Congress having appropriated $50,000 for the purpose. Langley's machine was a tandem monoplane, 48 feet from tip to tip and 52 feet from bowsprit to the end of its tail. It was fitted with a 50-horsepower engine and weighed 830 pounds. Two attempts were made to launch it, Oct. 7 and Dec. 8, 1903, but on both occasions the aerodrome became entangled in the defective launching apparatus, and was thrown headlong in the Potomac River, on which the launching trials were made. On the second occasion the aerodrome was wrecked, the public press ridiculed the whole enterprise, and Congress refused to appropriate money for further experiments. The Langley aerodrome, fitted with a Curtiss motor and Curtiss controls, flew in 1913–14.

The experimenters of the second school, like those of the first, did not attain practical results. Just how much each of them contributed toward the final success it is hard to say. Most of them made valuable additions to the knowledge of the science, but all mixed the practicable with the impracticable in such a way as to make it risky to adopt their conceptions as to the basis of actual flight. The realization of power flight was thus left to the twentieth century—and to the Wright brothers. In view of the complex problems to be solved, this achievement was stupendous.

Wilbur Wright and his brother Orville Wright (qq.v.) began their experiments with a glider in the fall of 1900 at Kitty Hawk, North Carolina. There, on the barren sand dunes, these two intrepid investigators took all the theories of flight and tried them one by one—only to find, after two years of hard, discouraging work, that they were based more or less on guesswork. Thereupon they cast aside old theories and patiently put the apparatus through innumerable gliding tests, ever changing, adding, modifying—setting down the results after each glide, comparing and changing again and again, advancing inch by inch, until they had, at last, developed a glider wonderfully exact, which, when fitted with a light motor, also built by them, made initial flights on December 17, 1903, of from twelve to fifty-nine seconds' duration.

The Wrights did not make their achievements public at the time; in fact, until 1908 they flew only in private. But the report of their wonderful achievement went far and wide, stimulating those who had given up experimenting and inspiring others to take up the work. Octave Chanute, in 1902, went to France and related the early successes of the Wrights with their glider, and described the general shape of the Wright machine. As a result half a dozen enthusiasts, including Louis Blériot, Captain Louis Ferber, Ernest Archdeacon, and later the Voisin Brothers and Alberto Santos-Dumont, took up the work, thus founding the French school which has increased so greatly and accomplished so much. The first of this school to succeed was Santos-Dumont (q.v.), the Brazilian aeronaut sportsman. He constructed a machine of original design, and in 1906 made short sustained flights of from 50 to 700 feet in straight line, which created a world-wide sensation. In the meantime, others of the French school won honors. The Voisin brothers turned constructors and teachers, and with their coöperation Léon Delagrange, Henry Farman, Louis Blériot, and others prosecuted practical experiments and succeeded in getting their creations to leave the ground for modest flights. At this juncture, in the summer of 1908, the Wrights started out to give public demonstrations, and their methods suggested to the French experimenters various modifications and improvements for their airplanes, particularly the means of balancing them, which had, until then, been a perplexing problem. Some months before this some American enthusiasts had combined under the auspices of Mr. Alexander Graham Bell, the inventor of the telephone, and Mrs. Bell, and organized the Aerial Experiment Association. Glenn H. Curtiss, one of the experimenters, developed a suitable type of airplane, and in 1908–09 became proficient in piloting it, and founded a school which did much in the following years to popularize and develop aviation in America.

The more important developments in the history of flying may be followed year by year.

On Sept. 15, 1904, Orville Wright, flying the Wright biplane near Dayton, Ohio, made the first turn. On Sept. 20 he made the first circle; on Oct. 4, 1905, he made the first flight of over half an hour, the flight having lasted thirty-three minutes and seventeen seconds. In 1905 also were founded the Aero Club of America and the International Aeronautic Federation.

In 1906 Alberto Santos-Dumont, the Brazilian inventor and pioneer in aeronautics, made the first public flight ever made. James Gordon Bennett presented the Gordon-Bennett International Aeronautic Trophy for free balloons, the contest for which was held from Paris in 1906, and was won by Lieutenant Frank P. Lahm, U. S. A., representing the Aero Club of America.

In 1907, the U. S. Army issued specifications for a military airplane, becoming the first country in the world to recognize the value of airplanes for military purposes.

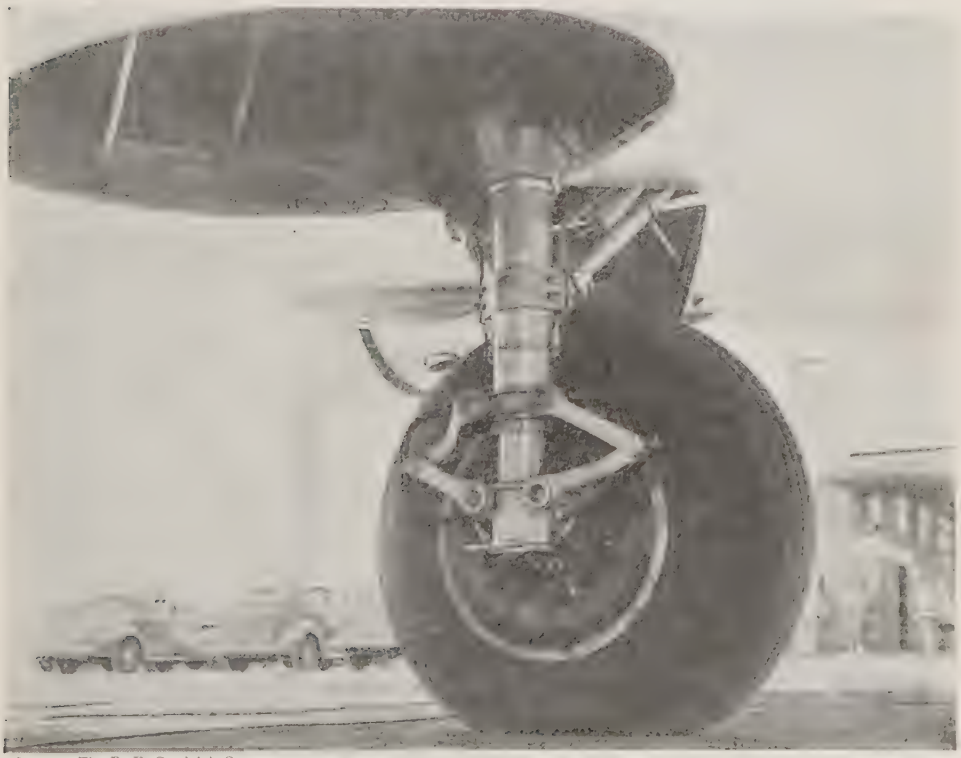
In 1908 the Wrights brought out their biplanes and practically taught the world to fly. Glenn H. Curtiss made the first public flights ever made in the United States. James Gordon Bennett presented the Gordon Bennett International Aviation Trophy, which was competed for in 1909, and was won by Glenn H. Curtiss, representing the Aero Club of America. This trophy was won twice in five years by representatives of the Club.

In 1900–10 two score of professional aviators toured the world giving public exhibitions, which aroused much enthusiasm at first, but which ended in performances too daring for the state of the art at the time, and cost the lives of a multitude of

Courtesy Douglas Aircraft Co., Inc.

CONSTRUCTION OF A GIANT MILITARY AIRPLANE

The U. S. Army's B-19, designed to fly 6,000 miles non-stop with a useful load of 28 tons.



Courtesy The B. F. Goodrich Co.

RETRACTABLE LANDING GEAR OF A LARGE PASSENGER TRANSPORT

In flight, this huge wheel is completely concealed in the nacelle in the lower surface of the wing.

Flying Machines

aviators. Blériot crossed the English Channel.

In 1911 a number of long-distance airplane races, such as the Paris-Madrid, Paris-Rome, Boston-Washington, New York-Pasadena, and the European, German, British, Belgian, Italian, Russian, Spanish and Swiss airplane circuits took place. In these events the airplane demonstrated such possibilities and practicability that the military authorities became impressed, and France, Russia, Italy, and Germany began to organize aerial forces. Glenn H. Curtiss made the first successful flight ever made with a hydroaeroplane.

The year 1912 was entirely a military year, practically every effort in European countries being given to developing and constructing military aircraft. This year also witnessed the first application of the airplane in actual warfare—in Tripoli.

In 1912, the Aero Club of America, and the editors of 'Flying,' founded by Messrs. Robert J. Collier, Henry A. Wise Wood and Henry Woodhouse, started a campaign of education, which resulted three years later in creating country-wide interest in aeronautics.

Most of the activity up to this time took place in Europe, and American aeronautics was practically at a standstill in so far as public interest or development of the military side was concerned. But Glenn H. Curtiss developed his hydroaeroplane and the flying boat, and introduced marine flying, an entirely new development, which created new interest and started a practical development that makes aviation even less dangerous than boating.

In 1913 all the European nations continued to add to their aerial forces, and at the end of that year they all had large fleets of airplanes and dirigibles, ranging in strength from 800 airplanes and two dozen dirigibles in France to 50 airplanes and half-dozen dirigibles in Japan. The French authorities successfully used airplanes in the Sahara colony.

Cross-country flying also developed rapidly, scores of aviators making long flights across many countries, including flights from Paris to St. Petersburg and return, 60 flights from Paris to London and return, a dozen flights across the Sahara Desert and over mountains, and many flights of from 500 to 1,300 miles carried out in a single day. The sport of water flying also progressed by rapid strides. Forty meets and races were held, and many long-distance cruises were undertaken by individual aviators, with great success. An average of 200,000 passengers were carried in flights monthly. Another most important innovation was the use of airplanes for carrying mail in France.

The records at the close of 1913 were as follows:—Speed: 125 miles an hour, for over an hour. Endurance: Fourteen hours without stopping. Touring: From Paris to St. Petersburg and back, and from Paris to Cairo, 3,500 miles, with one passenger, in a land airplane; 3,000 kilometres (1,875 miles) in a hydroaeroplane. Altitude: 20,295 feet, for aviator alone; 16,270 feet for aviator with one passenger. Greatest distance covered in twenty-four hours: 1,376 miles. Greatest distance covered in one day by aviator and one passenger: From Berlin to Paris. Weight carrying: Seven passengers on a two-hour flight; thirteen passengers for a short flight. Flying over water: Two flights across the Mediterranean Sea; half dozen across the Baltic; a score across the Great Lakes. Licensed aviation pilots numbered 6,000 in Europe. France had issued 2,000 licenses, England 700. Besides there were 7,000 students in training at aviation schools.

In America little progress was made outside of marine flying, but in that branch of aeronautics progress was great. American amateurs took to the new sport with enthusiasm, and a score of them acquired airboats for sport, while as many professionals used airboats and hydroaeroplanes for passenger carrying and demonstrating, and the season ended with a substantial promise for greater development in the coming year.

The year 1914 promised to bring about the application of aircraft for utilitarian purposes. Airship passenger lines were in operation in Germany; airplane mail-carrying tests were being made in France, England, and Algeria. In the United States, Rodman Wanamaker was financing the building of the 'America,' a large flying boat for crossing the Atlantic; the Aero Clubs of the world were coöperating with the Panama-Pacific Universal Exposition in arranging a round-the-world airplane race; and aviators all over the world were piling up new records.

Before the war airplanes were constructed in a more or less haphazard way, and up to the year 1916, the world's engineers who could design an airplane and calculate its performance before actually testing the airplane, were less than a score in number. Most airplanes built were copies of other airplanes with slight modifications, and there was little aeronautic engineering data available. In 1912–18 courses in aeronautic engineering were established at a number of American universities, but the purpose was mainly to give Army and Navy Air Service cadets an elementary course on the theory of flight, and to teach them the most elementary principles in the shortest time possible.

The greatest work in aeronautic engineering in the United States was done at the U. S. Army Aeroplane Engineering Department at Dayton in 1918–19, and at the largest airplane factories. Their work was, however, limited to some extent by the exigencies of war, which confined them to the analysis and construction of those types of aircraft which were being considered for production. It did not, to any extent, bring about the combining of the best characteristics of different machines of different countries, as might have been expected; nor did it result in the adoption of best engineering practice in aircraft construction. This was due to the fact that the problems of aeronautic engineering were too complex to be mastered within a year, even by the best engineers, while the necessity for lightness in construction did not permit the adoption of automobile or naval engineering practice.

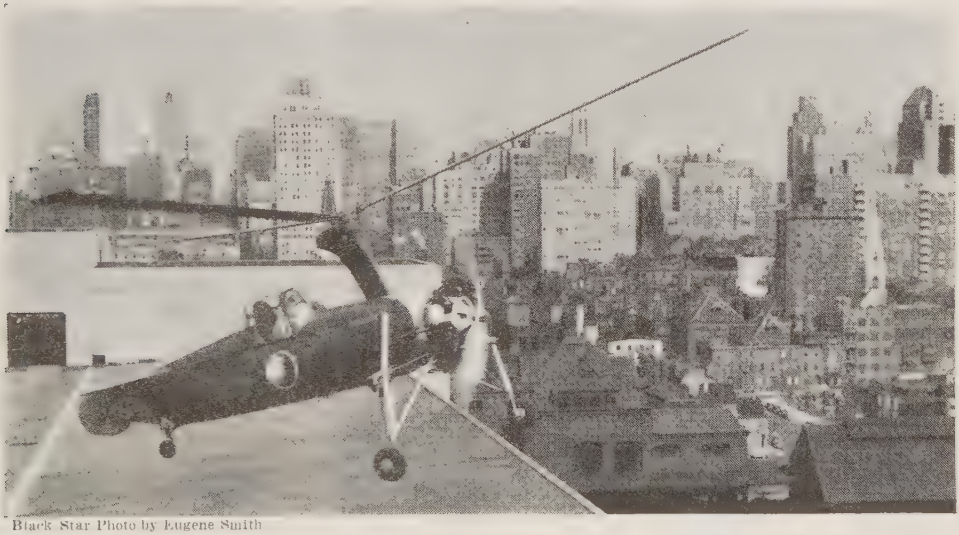
While collectively the developments in airplane construction brought about by the war represent a stupendous achievement, we find that as a whole the war requirements resulted in sacrificing flying efficiency to high speed and fast climbing. Machines were greatly overpowered, and such important factors for peace flying as low landing speed and high gliding angle were overshadowed. The increasing range of anti-aircraft guns forced high flying and was responsible for the development of high-ceiling airplanes of light construction and remarkable efficiency. The extension of night bombing operations brought about the construction of large airplanes such as the Caproni, Handley-Page, Vickers, Avro, etc.

The same thing was true in construction of seaplanes. The need of long-distance air cruisers and torpedo planes brought about the construction of large seaplanes, of which the various Curtiss types constructed in the United States and England are representative examples. The war also brought about the construction of seaplanes capable of starting and landing on fairly rough seas—a development of great importance for flying for sport, pleasure, and commerce.

The year 1927 was one of

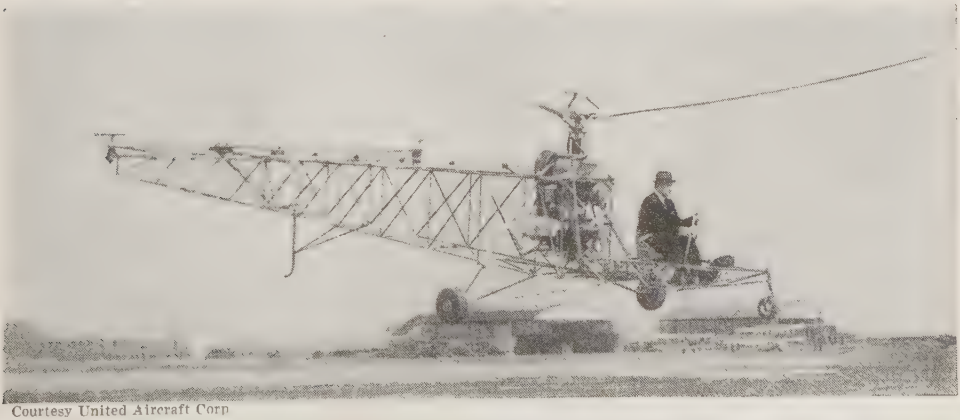
Courtesy Transcontinental & Western Air, Inc

FOUR-ENGINED BOEING STRATOLINER, HIGH ALTITUDE TRANSPORT



Black Star Photo by Eugene Smith

AUTOGIRO TAKING OFF FROM THE ROOF OF THE PHILADELPHIA POSTOFFICE



Courtesy United Aircraft Corp

SIKORSKY HELICOPTER IN FLIGHT

Still in its experimental stages, the helicopter may become an important means of aerial transportation.

epochal long distance flights, which captured popular fancy the world over, and in the United States, resulted in the revitalization of the aircraft industry, and its enormous expansion.

On the morning of May 20, 1927, at 7.53 o'clock, Charles A. Lindbergh, American air mail pilot, took off from Roosevelt Field, New York, and after a non-stop flight of 3,610 miles, landed at 10.24 o'clock on the night of May 21 at Le Bourget Field in Paris. His Ryan monoplane, the *Spirit of St. Louis* had a wing span of 46 feet and a gross weight of 5,000 lbs. It was equipped with a Wright aircooled 'Whirlwind' engine, and a Pioneer earth-inductor compass. World-wide acclaim greeted the modest young pilot, and his cheerful greeting to the crowd awaiting him, 'Well, we are here,' gave a new and vital significance to the word 'We.'

The great number of airplanes left on hand after the war, and the serious economic depression which accompanied post-war deflation, resulted in a period, from 1919 to 1923, during which little improvement was made in airplane performance. The extension of civil flying was most marked in Europe, where government subsidies resulted in an unhealthy growth of air transport lines over poorly chosen routes, and brought about a collapse and reorganization during 1924, when saner methods prevailed, and placed the infant industry on a firm basis. In the United States, the growth of commercial aviation was slower, but a wise policy of governmental support by experimental contracts for the acquisition of airplanes for the military and postal services, and encouragement without subsidy, brought about sound private financing, and prepared sound foundations for future growth. A transcontinental air-mail service was inaugurated by the Post Office Department, and was operated with marked success and increasing earnings until 1927, when it was turned over to private contractors, who continued its improvement, and extended it, until in 1928, 33 air mail and transport lines were in operation, and mail planes were flying a total average of 27,848 miles every twenty-four hours. Foreign air mail and passenger lines were added, extending the services to both coasts of South America, to Alaska and to the Caribbean.

On May 9, 1926, Commander Richard E. Byrd, U. S. N., and Aviation Machinist Floyd Bennett, U. S. N., flew from Kings Bay, Spitzbergen, to the North Pole and back, in a three-engined Fokker monoplane. On June 4, Clarence Chamberlin and Charles Levine flew from New York to Eisleben, Germany (108 miles from Berlin), a distance of 3,905 air line miles in 42 hours and 45 minutes, a world's record for uninterrupted flight. On June 28, Lieutenants Maitland and Hegenberger, U. S. Army Air Corps, after 25 hours and 50 minutes in the air, over 2,400 miles of open ocean, landed in Honolulu after taking off from Oakland, California.

Since then many crossings of the Atlantic and Pacific have taken place by individuals in sensational flights. In 1928 Kingsford-Smith, Ulm, and Lyon completed the first crossing of the Pacific from Oakland, California to Brisbane, Australia, in 81 hours 19 minutes. In 1929 Richard Byrd, Bernt Balchen, A. C. McKinley, and Harold June flew from Little America to the South Pole and back. In 1930 Lindbergh inaugurated an airmail service between the United States and South America, a 7,000 mile route.

In 1932 Amelia Earhart, by flying from Newfoundland to Ireland, became the first woman to make a solo transatlantic flight. In the same year J. A. Mollison made the first east-west transatlantic flight. General Italo Balbo, in 1933, led 24 planes in a flight from Orbetello, Italy, to Chicago, Illinois. In the same year Wiley Post made a round-the-world flight of 15,596 miles in 7 days, 18 hours, 49½ minutes. A non-stop record of 5,656 miles was set by Codos and Rossi in August of 1933.

The outstanding aeronautical event of 1934 was the MacRobertson Air Race from London to Australia held in October. A field of 64 started, among the competitors being some of the world's greatest men and women flyers. The race was won by Capt. T. Campbell Black and C. W. A. Scott who arrived in Melbourne 70 hours, 59 minutes, and 50 seconds after taking off from London. Also in October of that year the speed record for seaplanes was set at 440.67 miles per hour by Lieut. Francesco Agello, an Italian; the land plane speed record was set at 312.22 miles per hour in December by Raymond Delmotte of France.

In 1936 the *China Clipper* completed its first passenger flight from San Francisco to Manila. The *Yankee Clipper* inaugurated the first transatlantic mail and passenger service in 1939. War in Europe caused this line to limit its calls to Portugal. In 1940 passenger service linked the U. S. to New Zealand and Australia.

See also AERONAUTICS.

Flying Phalanger, *fa-lan'jer*, or FLYING OPPOSSUM, a name applied to several small marsupials, natives of New Guinea and Australia, where they are known as Flying Squirrels. Nearly allied to the phalanger (q.v.), they are distinguished by a hairy membrane or fold of the skin extending along both fore and hind legs almost to the toes, but not appearing behind the hind legs, nor including the tail. This membrane is used as a parachute, and enables them to leap great distances. They are nocturnal in habit, and feed on fruits, leaves, and insects.

Flying Robin, a fish allied to the gurnard (q. v.), belonging to the family *Cephalacanthidæ*. It is distinguished by the great size of its pectoral fins, which are used in the same way as those of the true flying fish, although their appearance is very different. The end of the fins is rounded and the tips of the rays extend beyond the membrane, while a long spine points backward from the gill cover on each side. One species inhabits the North Atlantic waters. It is about twelve inches in length and has habits similar to the flying fish.

Flying Squid, or SEA ARROW, popular names for a genus of cuttle (*Ommastrephes sagittatus*), sometimes called by naturalists the 'Winged Calamary.' The body is long, cylindrical, and pointed posteriorly, with two broad, short triangular fins, by help of which the animal can jerk itself out of the water, sometimes so high as to fall like a 'sea arrow' upon a ship's deck. Like other cuttlefish, these squids swim rapidly by forcibly ejecting water from their mantle or gill cavity. Gregarious in their habits, they prey upon shoals of mackerel and other fishes, and are themselves devoured by dolphins and other cetaceans, as well as by marine birds. They occur freely in the North Atlantic, and are extensively used as bait in the cod fisheries of Newfoundland. See CUTTLES.

Flying Squirrel, a name applied to members of two families of rodents: (1) the *Sciuridæ* (squirrels), including the genera *Pteromys* and *Sciuropterus*, and (2) the *Anomaluridæ*, to which belong the flying squirrels of Africa. The former are distributed throughout Europe, Asia, and North America, and are characterized by the possession of a flying membrane (*patagium*) extending from the flanks between the fore and hind legs. By virtue of its elasticity this membrane, normally lying close to the body, is put on the stretch when the limbs are extended, enab-

ling the animal to glide for considerable distances through the air.

The common North American Flying Squirrel (*Sciuropterus volans*), or Assapan, abundant in the woods from Upper Canada to the Gulf of Mexico, has a body from five to six inches long, with a rudder-like tail of the same length. Its fur is slate grey, overlaid with mouse brown on the upper parts, and is exceedingly soft and silky. In habit it is nocturnal and arboreal, making its home in hollow tree trunks or nests of leaves and twigs hung in forking branches. In gliding from tree to tree it descends obliquely and with an exceedingly rapid motion, sometimes for a distance of 20 yards.

Flynn, WILLIAM JAMES (1867–1928), American public official, was born in New York City. In 1897 he joined the U. S. Secret Service, and soon became the head of the Eastern division; in 1910–11, as second deputy commissioner of the New York Police Department, he reorganized the New York detective bureau; and in 1912 was promoted to be chief of the U. S. Secret Service, a position he held until 1917, when he became chief of the secret service of the U. S. Railroad Administration. In 1919–21 he was connected with the Bureau of Investigation, U. S. Department of Justice.

Flynt, flint (WILLARD) JOSIAH (1869–1907), American sociologist and author, was born in Appleton, Wis. He was educated at the University of Berlin (1890–95), and subsequently became a professional vagrant in order to carry on his sociological studies. His publications include *Tramping with Tramps* (1899); *The Powers That Prey* (with F. Walton, 1900); *Notes of an Itinerant Policeman* (1900); *The World of Graft* (1901); *The Little Brother* (1902); *The Rise of Ruderick Clowd* (1903); *My Life* (posthumously, 1908).

Fly River, a large river in Southern New Guinea. It rises in Victor Emanuel mountains, near the central part of the island and after a southerly and then a southeasterly course empties into the Gulf of Papua. It is almost 800 miles long and for nearly 100 miles of its course forms the boundary between Dutch and British New Guinea. As it enters the Gulf of Papua it forms a huge estuary nearly 50 miles in width, filled with low mud islands, the largest of which, Kiwai, is inhabited. There are two large tributaries, the Strickland and the Alice, and about 500 miles from its mouth the Fly itself divides into two nearly equal branches, the left of which is known as the Palmer River. No white settlers are found in the vicinity and it is swampy and unhealthy, except for natives.

High land is found about 500 miles up the river and here the nights are cool and more healthful. The river is of no commercial importance in spite of its great length.

The river was first discovered in 1842 and was explored in 1875–77 by D'Albertis, who ascended to the entrance of the Alice River. In 1885 Captain Everill discovered the Strickland River and the Alice was explored in 1913 by Murray and in 1922 by Austen. Consult W. N. Beaver's *Unexplored New Guinea* (1920).

Flysch, flēsh, a massive sandstone formation which is a characteristic member of the Cretaceous and Lower Tertiary rocks of the Eastern Alps. It is known also as the Vienna Sandstone, the Carpathian Sandstone, and Macigno. It seems to represent the accumulations of a very prolonged period ranging from Lower Cretaceous through Upper Cretaceous into Tertiary times, and consists of dark sandstones, shales, and argillaceous limestones, which, as a rule, are almost devoid of fossils, though frequently on the bedding planes worm casts and plant-like impressions may be found. Often the flysch contains large rounded boulders, some of which have come from the Alps, but others cannot be definitely assigned to any series of rocks at present known in Eastern Europe. In the Swiss beds fossil fishes have been discovered.

Fly Snapper, a name applied to a species of American flycatcher found in Southern California, Nevada, and Arizona. It is between 7 and 8 inches in length. The male is lustrous black, with white on the upper part of the wing feathers; the female is a brownish gray with crested head. The fly snapper builds its rude nest in trees or bushes, and lays two heavily speckled eggs. It has a rattling call, and its food consists mainly of berries.

Fly-trap. See DIONÆA MUSCIPULA.

Flywheel, a large, heavy-rimmed wheel attached to a machine or a steam or gas engine. By its momentum it tends to maintain equal velocity of the engine during each complete revolution. Its action depends on the principle that matter in motion possesses kinetic energy. The velocity should not exceed 80 feet per second for cast-iron wheels, and 50 feet per second for built-up wheels.

In a single-cylinder steam engine the flywheel preserves the energy gained during the most effective portion of the stroke (*i.e.*, with the piston nearly or quite at right angles to the crank) and carries it over the least effective part, or dead centre (when the piston and crank are approximately in one line), so that an even velocity is obtained throughout the stroke. The same result is attained in a gas engine, in which the explosion occurring at one point of each stroke would tend to produce a succession of jerks, if the surplus energy were not absorbed by the mass of the flywheel, to be given out again through the remainder of the stroke. An ordinary sewing machine has a flywheel for the same purpose. In other machines it has a similar function, except that the driving force is constant (or nearly so), while the resistance of the machine varies, as in a stamping or punching machine.

A rotating part used for other purposes may serve also as a flywheel. Thus, an electric generator must run at very uniform speed, and when driven by a steam engine it requires a heavy flywheel to equalize the impulses of the engine; but the rotor of the generator is in some cases heavy enough to make a separate flywheel unnecessary. The weight and size of fly-wheels are often determined empirically, but may be calculated by the formulas of mechanics from the allowable speed variation, and the rate of power supply and power consumption; or, in place of the last two, the total excess of energy which is supplied or consumed during a known part of the working cycle.

Flywheel duty is expressed either by the allowable speed variation, or by the *coefficient of steadiness*, which is equal to mean speed divided by speed variation, and may range from 5 for hammering and crushing machinery to 300 or higher for electric generators. The variation E (foot pounds per cycle) in power supply or consumption which can be compensated by a flywheel of weight W (pounds) and radius of gyration r (feet), or moment of inertia $I = Wr^2$, is approximately $E = \frac{1}{10} I \frac{N^2}{c}$, where N represents the mean speed (revolutions per second), and c the coefficient of steadiness.

This formula, which can be used to compute the required flywheel size for a punch press or similar machine, shows that the effect of a fly-wheel increases as the square of its speed. Flywheels are therefore run at high speed, and sometimes burst, doing great damage. Insurance against flywheel explosions is a

regular part of the insurance business. (See INSURANCE, CASUALTY.)

The bursting stresses in two similar wheels are to each other as their peripheral speeds. One-piece cast-iron wheels should be limited to a rim speed of 100 feet per second, and wheels cast in parts with joints in the rim to 50 feet per second (link joints may be higher). Special designs of wheel have been successful at speeds of 200 feet per second. In C. H. Benjamin's bursting tests of fly-wheels, various types of cast-iron wheels burst at speeds of 190 to 425 feet per second. Wheels built up of steel-plate segments, bolted and keyed together to form a ring or a disc, have been used for heavy wheels requiring to be run at very high speed.

For Benjamin's tests, consult *Proceedings American Society of Mechanical Engineers;* for designs of fly-wheels and rim joints, and tables of speeds, Halsey's *Handbook for Machine Designers and Draughtsmen.*

F. O. B., an abbreviation of *free on board,* used on invoices of goods when the seller contracts with the buyer to pay the cost of transport by ship or freight train. His responsibility then ceases, and the goods thenceforth belong to the buyer.

Foca, fot'cha, or FOTCHA, town, Jugoslavia, in Bosnia, at the junction of the Drina and Tchehotina Rivers; 30 miles southeast of Sarajevo. The chief industry is silver and gold inlaid work. Foca is of ancient origin, and early became commercially important, as it was on the direct route between Ragusa and Constantinople. Pop. 5,000, largely Mohammedan.

Foch, fosh, FERDINAND (1851–1929), French soldier, generalissimo of the Allied armies during the Great War (1914–18), was born in Tarbes, Southern France. He entered the École Polytechnique at Metz in 1871, was graduated as an artilleryman, and in 1884 was admitted as a student to the École de Guerre, to which he returned twelve years later, as an instructor, with the rank of major. In 1901 he was sent back to the line as lieutenant colonel, and in 1907 again returned to the École de Guerre as commandant, with the rank of brigadier general. Resigning the position in 1912, he was successively in command of the Eighth and Twentieth Army Corps.

At the outbreak of the Great War General Foch was called from Nancy, headquarters of the Twentieth Corps, to take command of the Ninth Army. At the Battle of the Marne (q.v.), in command of the French centre, he shared with Marshal Joffre the credit for stopping the German advance on Paris, at Ypres (q.v.) he led the French and British armies in the action that saved the channel ports, and in 1916 he took part in the Battle of the Somme. He represented France on the Supreme War Council of the Allies, and on March 29, 1918, was placed in supreme command of the Allied forces on the western front. He halted the great German advance of the spring of 1918, and conducted the powerful offensive that drove the enemy back along the entire western front, and resulted in the signing of the armistice (Nov. 11, 1918) that ended the war (see ARMISTICE).

In 1921 he visited the United States where he was everywhere welcomed with acclaim and received degrees from almost every university in the country.

He died in Paris, March 20, 1929, after an illness of several months and after lying in state beneath the Arc de Triomphe by the side of the Unknown Soldier was buried in the Hôtel des Invalides.

General Foch was made a grand officer in the Legion of Honor following the Battle of the Marne; King George of England bestowed upon him the Grand Cross of the Order of the Bath and the Order of Merit, and President Wilson awarded him the Distinguished Service Medal. He was made Marshal of France in September, 1918, and later was elected a member of the French Academy. He is the author of *The Principles of War* and *The Conduct of War.*

Focsani, fōk-shän'y, or FOKSHANI, town, Roumania, 55 miles northwest of Galatz. The chief industries are tanning and the manufacture of oil and soap. The vicinity is rich in iron, copper, coal, and petroleum, and wine is produced at Odobesci nearby. Here (1789) Suvorov won a brilliant victory over the Turks. The town was occupied by the Germans early in 1917. Pop. 25,000.

Fo'cus, in its original and usual significance, is a point toward which rays of light and radiant heat are made to concentrate, so as to produce an intense brightness and heat. By generalization, it is applied to any point through which a number of rays pass, or act as if they had passed, although no intense heat is produced.

When a parabola is made to revolve about its axis, it describes the paraboloid; and if rays parallel to the axis fall on this surface, they are reflected so as to pass through a point known as the focus of the paraboloid and of the generating parabola. Similarly, when an eclipse is made to rotate about its principal axis, it describes a spheroid; and with respect to this spheroid and generating ellipse there are two points such that if one is made a radiant point, the rays emitted from it and reflected from the surface will all pass through the other. These points are the so-called *foci* of the spheroid and ellipse.

In Geometry, the term focus is used in a general sense as a point through which important lines pass, or with reference to which the connected curve or surface has special properties. The term is also used as a source of energy—*e.g., seismic focus,* the centre of an earthquake disturbance. In Photography, to focus an image is to vary the distance of the ground-glass screen from the lens in front so that the picture presented is clearly defined. In Medicine the term denotes the chief centre of a morbid process.

See LENSES; REFLECTION AND REFRACTION; ELLIPSE; HYPERBOLA; PARABOLA.

Fodder, the food collected by man for the use of live stock on the farm, as hay, grass, straw, cut green food, and roots. *Fodder crops,* as distinct from root crops, include grass, clover, cowpeas, alfalfa, field peas, corn, rye, barley, oats, vetches, and the like. See AGRICULTURE; FEEDING STUFFS; ENSILAGE; HAY.

Foehn. See FOHN.

Fœnic'ulum. See FENNEL.

Foerster, furs'ter, WENDELIN (1844–1915), Bohemian philologist, was born in Wildschütz, near Trautenau. He became *privat docent* for Romance philology at Vienna; and succeeded Diez at Bonn in 1876. He edited a number of Old French texts, notably the works of Chrétien de Troyes (1884 *et seq.*).

Fœtus, fē'tus, or FETUS, the term applied to a young viviparous animal as soon as its several members are distinctly formed, but before it has as yet attained development sufficient for independent existence. The fœtal stage is preceded by the *embryonic* stage of life, in which the organism is more rudimentary (see EMBRYOLOGY). In the human subject it is usual to speak of the embryo after the end of the third month as the fœtus.

Between the fœtus and the newly born child a sharp contrast is exhibited, their modes of nutrition and of blood oxygenation being widely different. The fœtus derives both nutriment and oxygen from the maternal blood by means of a structure known as the *placenta* (q.v.), in which both the fœtal and the maternal bloods circulate without com-

HUMAN FOETUS, MALE; SIZE, 150 MM.; APPROX. AGE, 18 WKS.

HUMAN FOETUS, MALE; SIZE, 155 MM.; APPROX. AGE, 18 WKS.

HUMAN FOETUS, MALE; SIZE, 155 MM.; APPROX. AGE, 19 WKS

HUMAN FOETUS, FEMALE; IN AMNIONIC SAC WITH PLACENTA; SIZE, 160 MM.; APPROX. AGE, 19 WKS.

HUMAN FOETUSES, FEMALE. IDENTICAL TWINS WITH PLACENTA AND UMBILICAL CORDS; SIZE 160 MM.; APPROX. AGE, 19 WKS.

HUMAN PLACENTA OF IDENTICAL TWINS; TWO UMBILICAL CORDS; AMNIONIC PARTITION IN THE PLACENTA

Photos courtesy John B. Murphy Hospital, Chicago

mingling, but in such a way that an interchange of substances is possible. In the placenta the maternal blood yields building-up materials and takes waste products, which the fœtal blood discards as it requires the substances necessary for its life and growth. The *umbilical cord* is the medium for the passage of the fœtal blood to and from the placenta; while the fœtal heart necessarily differs from that of a child, which acquires its oxygen by means of the pulmonary circulation.

The weight and the length of the fœtus at full term—nine months—vary within considerable limits. On an average, the fœtus at birth weighs from 6½ to 9 lbs. The usual length of the fœtus is 17 to 21 inches, but may be as much as 24 inches.

Although nine months is the normal period of fœtal development *in utero* (see GESTATION), it is possible for a fœtus to survive though born much within this period. See PREGNANCY; LABOR.

Fog, a meteorological phenomenon due to the condensation of aqueous vapor on dust particles and ions, by the cooling of masses of air in various ways, and by the commingling of two currents of air of different temperatures. Fog differs from *cloud* (q.v.) in being close to or in contact with the earth's surface, and from *mist* in the greater fineness of its watery particles. It descends very slowly on account of the friction or adhesive resistance of the air; while its density is determined by the amount of the dust particles.

The fogs on the Banks of Newfoundland are caused by the warm, moist currents of air from the Gulf Stream being carried over the cold water of the Banks —for the water off the latter in July is no less than 33° F. colder than the Gulf Stream 300 miles to the east.

A converse cause of fog production is the sudden chilling of saturated air in contact with a warm surface of water. This effect is well seen in severe frosts, when fogs form over running streams, because the water, being warmer than the air, gives off a greater quantity of vapor than the cold air can contain, and the excess is precipitated as fog. Fog is also formed by radiation when the ground is cooled below the dew point (see DEW), all the superfluous moisture in the lowest stratum of air being deposited as dew, while the air close to the soil is saturated, and at the same time colder than the strata above it. If no mixture with the upper air takes place, as is the case when the ground is level, no fog forms, as a rule; but if the ground slopes, the colder air flows into the hollow, and mixes with the layer in the low-lying ground, thus producing a fog.

Fog bow is a white rainbow seen in a thick fog. The fog particles of water which float in the air are extremely small—less than one-hundredth of an inch in diameter. The interference is then more effective than simple refraction; the prismatic colors which we know in the ordinary rainbow become mixed, and the arch is broad and of a faintish white color, from 38° to 41° in diameter. *Fog crystals* are a form of solid precipitation frequently observed on mountain summits, and occasionally at lower elevations, during intense frost combined with thick fog.

See DUST, ATMOSPHERIC; FOG SIGNALS; HAZE; SMOKE.

Consult J. Aitken's *Dust Fogs and Clouds*.

Fogaras, fō'gȧ-rosh, town, Roumania, in Fogaras County, on the Aluta; 43 miles by rail east of Hermannstadt (Sibiu). Tobacco and grain are cultivated, and there are distilleries. Near the town the Hungarians were defeated by the Russians in 1849. Pop. 6,500.

Fogazzaro, fō-gät-tsä'rō, ANTONIO (1842–1911), Italian poet, novelist, and philosopher, was born in Vicenza. He studied law at Turin and Milan, was for several years a member of the Italian Senate, and also served for some time on the Council of Public Instruction, but the greater part of his life was devoted to literary pursuits.

Fogazzaro first attracted the attention of the literary world by the publication of his poem *Miranda* (1874) and a volume of lyrics, *Valsolda* (1876); but, while his poetry is exceedingly vivid and expressive of deep emotion, it is mainly as a prose writer that he is known. His first novel, *Malombra* (Eng. trans. *The Woman*, 1907), was published in 1881, and was followed by *Daniele Cortis* (1885; Eng. trans., *The Politician*, 1908), considered by some his best work, by *Il Misterio del Poeta* (1888), and by his famous trilogy *Piccolo mondo antico* (1895), *Piccolo monde moderno* (1901), and *Il Santo* (1905), translated into English (1907) respectively as *The Patriot, The Sinner*, and *The Saint*. The publication of *Il Santo* brought Fogazzaro into direct conflict with the Church. A devout Roman Catholic, in the ordinary sense of devotion, the author nevertheless belonged to the Liberal Party, which held a more comprehensive view of its faith than was strictly consistent with the Church's teaching. In writing *Il Santo* he attempted to further the cause of Modernism, and the book is permeated by a spirit of half-mystical individualism. It was condemned by the Holy Office and placed on the Index. Without condemning his *Saint*, Fogazzaro let it be understood in *Leila*, published posthumously (1911), that his former teachings might have been erroneous. Consult *Life*, by Molmenti.

Fogbow. See FOG.

Fogelberg, fō'gel-bâr-y', BENGT ERLAND (1786–1854), a Swedish sculptor, was born in Gothenberg. He studied in the Academy of Stockholm, and at Paris, and went to Rome, where he was influenced by Thorwaldsen. He is perhaps best known for his Odin, one of the three colossal marble statues of the Scandinavian gods at the National Museum of Stockholm, though the other two of the group, Thor and Balder, completed in 1845, are even greater works of art. His colossal historical statues of Gustavus Vasa, Birger Jarl, and Charles XIV., unveiled in 1854, are also well known.

Foggia, fod'jä, province, Southern Italy, known as *Capitanata* prior to 1871, lies between the Apennines and the Adriatic Sea; area, 2,683 square miles. Except for the high promontory of Monte Gargano (3,460 feet), in the northeast, the province belongs to the great Apulian plain. The coast is low and flat; the climate hot and dry. Since Roman times, sheep raising has been the chief industry. Other products are wine, oil, and grain. The capital is Foggia (q.v.). Pop. (1921) 458,502.

Foggia, city and episcopal see, Italy, capital of Foggia province; 125 miles by rail northeast of Naples. The twelfth-century Norman Cathedral was damaged by an earthquake in 1731, and has been largely rebuilt in modern style. The city also contains a fine custom house, theatre, technical institute, botanical gardens, and the palace where the Emperor Frederick II. (1194–1250) resided. Industries include sheep raising, grain growing, and the manufacture of oil and wine. An important fair is held annually in May. Pop. (1925) 72,306.

Fog Horn. See FOG SIGNALS.

Fogo, fō'gō, the loftiest of the Cape Verde Islands, lying to the west of Santiago; area, 170 square miles. The chief town is Nostra Senhora da Luz. Pop. 16,000. See CAPE VERDE ISLANDS.

Fog Signals are of two classes —those made by vessels to indicate their positions to others for the purpose of avoiding collision, and those made by shore stations to give warning of danger to approaching or passing vessels.

The International Rules for the navigation of vessels 'in a fog, mist, falling snow, or heavy rainstorm' provide as follows:

(*a.*) Vessels must proceed at a moderate speed.

(*b.*) Upon hearing a fog signal forward of the beam a steamer should stop her engines and navigate with care until danger of collision is over.

(*c.*) Steam vessels must be provided with a whistle or siren, an efficient foghorn to be sounded by mechanical means, and a bell. Sailing vessels of 20 tons or more must have a similar foghorn and bell.

(*d.*) A steam vessel under way must sound a blast on her whistle at least once every 2 minutes (U. S. law, every minute). If underway but stopped, she must sound 2 blasts with 1-second interval every 2 minutes.

(*e.*) A sailing vessel must sound her foghorn once every minute as follows:—when on the starboard tack, 1 blast; on the port tack, 2 blasts; with wind abaft the beam, 3 blasts.

(*f.*) A vessel at anchor must, once every minute, ring her bell rapidly for 5 seconds.

(*g.*) A vessel towing, or handling a telegraph cable, or not manageable or able to manœuvre, must every 2 minutes (U. S law, every minute) sound 1 long blast followed by 2 short blasts. A vessel being towed may make this signal and must make no other.

(*h.*) Boats and sailing vessels of less than 20 tons (gross) are not obliged to make the foregoing signals; but, if they do not, they must make some other efficient signal at intervals of a minute or less.

The fog-signal apparatus at shore stations on the U. S. coast consist of:—(*a*) steam whistles of ordinary type but large size; (*b*) steam sirens; (*c*) Daboll trumpets; (*d*) bells struck by machinery; (*e*) whistling buoys; (*f*) bell buoys. Of these the siren can be heard at the greatest distance—occasionally as far as 30 miles. The buoys are placed on outlying dangers or at entrances to channels. Nearly all lighthouses are provided with a whistle, siren, trumpet, or bell.

These fog-signals fail to give entire satisfaction as such from two causes. First, the wind frequently reduces the distance at which signals may be heard; secondly, it is difficult to ascertain the direction from which the sound proceeds. The first difficulty is met by increasing the power of the apparatus and the second is partly overcome by the Foster sound director and direction signals and the Heap topophone. The sound director consists of a group of 8 megaphones placed radially about a centre. Through each megaphone a different series of blasts is sent and the series most plainly heard, indicates the direction. The Heap topophone consists of two flexible tubes leading from the ears to bell-shaped metal mouths secured to opposite sides of a staff. By turning the staff back and forth the sound is heard most clearly first in one ear and then in the other, so that the approximate direction is quickly ascertained. See *Revised Statutes of the U. S.; U. S. Navy Regulations* (1905); *Rules of the Road* published by the U. S. Dept. of Commerce and Labor, and by various maritime associations.

Föhn is the warm, dry wind of Alpine valleys. As the air accends the mountains it expands and cools, and this cooling condenses the vapor, which falls as rain on the windward side, setting free the latent heat in the vapor. The air, in descending the mountain, is dynamically heated by compression at the rate of 0.6° F. for every hundred feet of descent. The föhn produces much physical discomfort, oppressing the spirits, and putting a strain on the nervous system. See Hann's *Handbuch der Klimatologie*, i. 332–349; 2d ed. 1897; Eng. trans. of vol. i. 1903. See CHINOOK and NOR'WESTERS.

Föhr, one of the N. Frisian Is., lying off the W. coast of the Prussian prov. of Schleswig-Holstein. Area, 28 sq. m. Pop. 4,500. Chief town, Wyk.

Foil, a thin sheet of metal. The term is limited to material intermediate in thickness between gold leaf and such substances as sheet copper. Not all metals are amenable to the operations of rolling and hammering involved in the production of foil; the requisite properties are softness and tenacity both of which again depend largely on temperature. Metallic substances were formerly made into foil by hammering and polishing. Latterly, however, this method has been superseded by squeezing them out into sheets of the desired thickness by passing bars of metal through a series of heavy rollers. Owing to the unnatural strain imposed upon the particles by this treatment, the metallic sheets are annealed by heating them after every two or three rollings and then allowing them to cool slowly. The chief varieties of foil now made are copper, tin (used for wrapping chocolate, tobacco, etc.), lead, aluminium, silver, and gold. Gold, silver, and tin foil are used by the dentist as fillings for teeth. See also GOLD LEAF.

Foil, a weapon. See FENCING.

Foix Family, THE, an old French family who took the title of 'count' from the district of Foix. The chief member of the family was Roger (d. 1012), who distinguished himself in the first crusade. Early in the 13th century Raimond Roger (1188–1222) took a leading part in the Albigensian movement, which was suppressed by Simon de Montfort, who confiscated Roger's property. In the middle of the 15th century Eleanor, daughter of John II. of Aragon, and heiress of Navarre, married Count Gaston IV., who died in 1472. At the beginning of the 16th century Catherine de Foix and her husband, John d'Albret, ruled over Navarre, while the younger branch, represented by Gaston de Foix, Louis XII.'s nephew, claimed that kingdom. Gaston, who distinguished himself in the Italian wars, was killed at Ravenna (1512), and his claims passed to his sister Germaine, wife of Ferdinand of Spain, who occupied all that portion of Navarre which lay on the Spanish side of the Pyrenees. On the accession of Henry of Navarre to the French throne the remainder of Navarre was absorbed into the monarchy of France.

Fo-kien. See FU-KIEN.

Fokshani. See FOCSANI.

Folard, JEAN CHARLES, CHEVALIER DE (1669–1752), French soldier and writer on military affairs, was born at Avignon. He was the first great advocate of the column formation for the fighting line afterwards adopted and developed by Napoleon. His works include *Nouvelles Découvertes sur la Guerre* (1724), and *Commentaire sur Polybe* (1727–30).

Folcland. See FOLKLAND.

Folc-right. This was the common law of England, written or traditional, in pre-Norman days, and administered in the hundred court and folc-moot.

Folds. Rock strata seldom lie in their original horizontal position. They are more commonly tilted and, when their separated parts are connected, form a series of arches and troughs that are known as folds. All degrees of folding from shallow and broad to profound and close folds occur. Mountain ranges are regions of excessive folding. Folds are closely related to faults, especially to the overthrust. They are caused by the shrinkage of the earth and the consequent necessity of the more rigid outer layers accommodating themselves to the crustal shortening. Locally less profound causes may produce similar results. Geologic literature recognizes many varieties of folds. To interpret these structures correctly is often a very difficult task. Many prominent physiographic features are the result of erosion on a series of folded rocks. The Appalachian

mountain ridges are of this origin.

Földvar. See DUNA-FÖLDVAR.

Folengo, TEOFILO (1491–1544). Italian monk and macaronic poet, known also by his alternative literary name, 'Merlino Coccajo,' born at Cipada, near Mantua; entered the Benedictine order, but for many years led a wandering life. His earliest work was *Opus Merlini Coccaji, poetæ mantuani, maccaronicum* (1518), a sort of romance in verse. Later works are *Orlandino* (1526), a satiric poem in rhyming octaves; *Chaos del tri per uno* (1527); and *L'Umanità del Figliuolo di Dio* (1533), a life of Christ. His *Opere Maccheroniche* were published in 3 vols. in 1882–80.

Foley, JOHN HENRY (1818–74), Irish sculptor, born in Dublin; studied in the schools of the Royal Dublin Society, and entered the Royal Academy Schools at London when seventeen. His *Death of Abel* and *Innocence* were exhibited in 1839, and *Ino and Bacchus* in 1840. The appearance of his *Youth at the Stream*, at Westminster Hall (1844), led to a commission to execute statues of Hampden and Selden for the Houses of Parliament. He was elected A.R.A. (1849), and full member (1858). Among his chief works are *Carartacus* and *Egeria* (Mansion House, London), *O'Connell*, *Goldsmith*, and *Burke* (Dublin), *Asia*, and the figure of the *Prince Consort* (Hyde Park), *Lord Herbert* (Pall Mall), and *Sir Charles Barry* (Westminster). His equestrian statues, *Lord Hardinge*, *Lord Canning*, and *Sir James Outram* are in India. He designed the seal of the Confederate States of America during the Civil War, and for South Carolina executed his last work, a bronze statue of Stonewall Jackson. Poetic feeling and purity of conception are characteristics of his work, while he attempted to express modern ideals and domestic sentiments in classic form. See Cosmo Monkhouse's *The Works of J. H. Foley* (1875).

Folger, CHARLES JAMES (1818–84), American lawyer and politician, was born on Nantucket, Mass. He graduated at Hobart College, in 1836, and began to practice law at Albany in 1839. He became judge of the Court of Common Pleas of Ontario co. in 1843, and in 1861–69 was a member of the state senate. In 1871 he was elected associate judge of the state Court of Appeals, and he became its chief justice in 1880. He was secretary of the U. S. treasury in President Arthur's administration in 1881–84. In 1882 he was the Republican candidate for governor of New York, but owing to the alleged interference of President Arthur with the choice of the convention, he was defeated, and Grover Cleveland elected by 192,000 majority, bringing Mr. Cleveland prominently forward as a Democratic candidate for the presidency.

Folger, PETER (*c.* 1618–1690), American colonist, was born probably in Norwich, England, and emigrated to Watertown, Mass., in 1635. He subsequently removed to Martha's Vineyard, and from there to Nantucket, being occupied with the teaching of the Indians. Benjamin Franklin, whose maternal grandfather he was, praises his poem, *A Looking-Glass for the Times; or, the Former Spirit of New England Vindicated* (1675).

Folgoré, GIUSEPPE, Italian poet of the 13th century, wrote several sonnets, the merit of which is varying, some being excellent, others almost beneath contempt; they have been translated into English by D. G. Rossetti and J. A. Symonds. He gives vivid pictures of Italian life and manners during his age. See D. G. Rossetti's *Dante and his Circle* (1874); Navone's *Le Rime di Folgore* (1880); also J. A. Symonds's *Italian Literature* (1881).

Foliation. Rocks of the group known as the metamorphic schists and gneisses have usually their component minerals arranged in layers, which are thin, lenticular, often bent or tortuous. They are called folia, and the rock is said to have a foliated structure. The individual laminæ may consist principally of quartz, of felspar, mica, or hornblende, etc When they are thin, regular, and parallel, they resemble lines of bedding in sedimentary rocks; but this is not frequent. As a rule, they are sinuous, and thin out rapidly while fresh folia of similar composition take their place. In the gneisses the folia are thicker than in the schists. In mica schists, for example, they are often as thin as sheets of paper, and may be much crumpled. In augen gneisses certain folia are thick and short, elliptical in section, resembling eyes (hence the name), while others wind round and envelop them. The 'augen' consist usually of felspar or quartz, the other folia of mica or hornblende.

Foligno, or FULIGNO, tn. and episc. see of Italy, prov. Perugia, 25 m. by rail S.E. of Perugia. It has an ancient cathedral, and manufactures woollens, silks, etc. Pop. 26,277.

Folk, JOSEPH WINGATE (1869–1923), American lawyer and reformer, born at Brownsville, Tenn., graduated at Vanderbilt University and admitted to the bar in 1890. He began to practise law at St. Louis, where he was elected circuit attorney for the term 1900–1904. The political situation was peculiar. The spoils system had reached its zenith under the administration of Mayor Ziegenhein, familiarly 'Uncle Henry,' or, as it was explained, 'St. Louis got ripe and went to rot.' Reform was unexpected and in a large measure accidental, inasmuch as the advertisement of reform candidates by the Democratic party was intended to serve no other than campaign purposes. Folk's asseveration, upon his reluctant acceptance of the nomination, that he would punish the lawbreakers, was received as a conventional promise on the part of a candidate. Immediately upon his election he began to deal with charges of election fraud like cases of ordinary crime, and in spite of the frantic expostulation of the bosses sent several of the rank and file of the old ward heelers and party workers to prison. In connection with the purchase of the Suburban Railway Co. by the St. Louis Transit Co. the Municipal Assembly made grants which raised the value of the property from $3,000,000 to $6,000,000. A mandate from the court caused a delay in the transfer and a concomitant hitch in the payment of bribes amounting to $144,000. The legislators, however, demanded their 'perquisites' at once, and in the ensuing war with their bribers 'honor among thieves' did not prevent the escape of such a clue as the circuit attorney sought. Folk pushed his case with great ability and courage and bore the brunt of the fight single-handed. He sent eighteen members of the Municipal Assembly to the penitentiary, and others who were implicated only escaped by flight. This was the beginning of a complete system of reform. Folk was elected governor of Missouri for the term 1905–1909.

Folkes, MARTIN (1690–1754), English antiquary and scientist, born in London. The friend of Newton, he was appointed president of the Royal Society (1741–53). He was also president of the Society of Antiquaries (1749–50), was a linguist, archæologist, and collector of coins and medals. He published *A Table of English Gold Coins* (1736), *A Table of English Silver Coins* (1745). He also assisted Theobald with archæological notes for the latter's edition of Shakespeare.

Folkestone, municipal bor. and seapt. in Kent, 17 m. S.E. of Canterbury. It is a fashionable resort, and has regular packet service with Boulogne. The parish church is an ancient cruciform structure. The Leas is a beautiful parade along the cliffs. The

new pier and harbor works were completed in 1904, the work including the widening and strengthening of the old pier, and an extension 900 ft. in length. Folkestone was connected with the Cinque port of Dover. Folkestone figured in the evacuation of the British forces trapped by the surrender of Belgium to Germany in May 1940 during the European War. Pop. (1931) 35,890.

Folkland, or FOLCLAND, under the Anglo-Saxons was unappropriated territory belonging to the nation and administered by the king and Witan. From it the authorities might grant tracts to the church or to individual freemen, these tracts being 'boclands,' which carried no absolute right. Portions were later granted in perpetuity as reward to state servants, and were subject to certain services to the crown; other portions were rented to life tenants, the rent being payable in kind, maintaining the crown, and defraying public expenses. Norman kings had entire control of the folklands, henceforth known as *terra regis*, or 'crown lands.'

Folklore, a term originally suggested by an anonymous English writer (understood to be William J. Thoms) in the *Athenæum* of Aug. 22, 1846, as a collective name for traditional literature, customs, and superstitions found among the peasantry of civilized countries. The *Handbook of Folklore*, issued by the London Folklore Society in 1890, defined the science of folklore as 'the comparison and identification of the survivals of archaic beliefs, customs, and traditions in modern ages.' This definition, by implication, confined the subjects of folklore to civilized countries; but for scientific purposes, folklore may be defined in wider terms as traditional literature, beliefs, and practices current among peoples in all stages of culture, and the science of folklore as the science of tradition.

The earliest writer who in any systematic way set himself to collect folklore was John Aubrey (1626–97), the English antiquary, one of the first members of the Royal Society. His *Remains of Gentilisme and Judaisme* is a notebook apparently intended for the composition of an elaborate work comparing ancient and modern superstitions, and periodical and other traditional practices. Its chief importance is derived from the record of numerous English customs, either contemporary or the observance of which had been kept up until within living memory at the time of his writing. This work was practically unknown until Brand incorporated in his *Observations on Popular Antiquities* a few extracts, and it was not printed in its entirety until 1818.

A similar fate nearly overtook Brand's book. Henry Bourne (1696–1733), a young clergyman of Newcastle, England, had published in 1725 a work entitled *Antiquitates Vulgares, or the Antiquities of the Common People, giving an Account of their Opinions and Ceremonies.* It had become scarce in the course of half a century; and in 1777 John Brand (1743–1806), also a clergyman, republished it with considerable additions. Not satisfied with this, he continued his inquiries, in which he was helped by the foundation of the Society of Antiquaries, of which he became its secretary. Thomas Percy (1728–1811), afterwards bishop of Dromore, in 1765 issued his famous *Reliques of Ancient English Poetry*, the first collection of old ballads in England. In Denmark and in Sweden the old ballads had never ceased to attract the lively attention of the cultivated classes. But the three or four collections published there during the 16th and 17th centuries were unknown beyond the limits of Scandinavia. Percy's methods were anything but scientific: he did not scruple to alter and amend, or to fill gaps with sham antique patches. The ballads and other early writings contained allusions to customs and superstitions which began to be studied and elucidated by antiquaries such as Warton, Ritson, Douce, and Steevens, first for the sake of the completer understanding of the literature, and later for their own intrinsic interest They thus carried forward the work begun by Bourne. Scott followed in 1802 with his *Minstrelsy of the Scottish Border*, a production of the same character as Percy's, consisting of traditional ballads pieced out with admirable imitations. In the midst of the movement Brand's *Observations* were written. They formed a collection of accounts of old British customs and superstitions drawn from the most various sources, accompanied by acute comments, illustrated by quotations from English literature, and compared principally with the heathen practices of classical antiquity. Sir Henry Ellis (1787–1869), secretary of the Society of Antiquaries, published the manuscript in two volumes quarto, with considerable additions, in 1811.

Meanwhile the brothers Grimm had started on their quest of folk-tales in Germany. The first volume of their gatherings appeared in 1812. It was the earliest collection formed on the scientific principle of setting down what they heard exactly as they heard it, without embellishment, addition, or omission. In the main, this principle was faithfully adhered to. In 1822 the work was completed by the issue of a volume of variants and learned notes, directing attention to the recorded folk-tales in classical and mediæval literature, as well as in post-mediæval and Oriental literature. In his *Deutsch Mythologie* (1835) Jakob Grimm brought the wealth of his erudition to the exposition of the ancient Teutonic mythology and religious practices. Subsequent research has confirmed most of his conclusions, and the book still remains an authority.

During the decade and a half which followed the publication (1859) of *The Origin of Species*, a group of distinguished Englishmen devoted themselves to the investigation of the early condition of mankind and the development of civilization. Chief among them in England was E B. Tylor, whose two books, *Researches into the Early History of Mankind* (1865) and *Primitive Culture* (1871; 4th ed. 1904), placed the inquiry into the psychological, as distinguished from the physiological, development of mankind on a thoroughly scientific footing.

In Germany, Mannhardt, renouncing the philological method of interpreting myths (of which the expositor best known was Professor Max Müller) in his book on *Wald-und Feldkulte* (1875; 2d ed. 1904–5), expounded the intimate connection between myth and folk-tale on the one hand, and custom and superstition on the other. The establishment, in 1878, of the London Folklore Society materially aided the development of the study. Its publications, now issued under the title of *Folklore*, etc., extend to over fifty volumes. Similar societies have been established in most of the countries of Western and Central Europe. In connection with the exhibition at Paris, in 1889, a Congrès des Traditions Populaires was held. This was followed by an International Folklore Congress at London, under the presidency of Dr. Andrew Lang, in 1891, and a similar congress at Chicago in 1893. A second congress was held at Paris in connection with the exhibition of 1900.

The importance of folklore arises from the fact that its elements survive among the culture of civilized nations, connecting them with the dim ethnic past. For example, the few of the beliefs and observances now traditional among the peasantry of Europe which are not traceable to a religious source or at least

to originals which bear a deep religious imprint. The annual procession and legend of Lady Godiva have been traced to a religious ceremony practiced by the ancient Britons. Harvest-home gatherings appear to embody relics of sacred rites and human sacrifice.

The use of charms to heal wounds or diseases is a survival of the ancient magic, whereby it was held that the employment of proper formulæ and the accurate performance of suitable ceremonies had of themselves an inherent value, and that supernatural beings and even material objects were compelled to obey them.

The nursery and fairy tales of Europe belong in large part to a common stock. Many of them, such as the story of Melusina, are found practically all over the world—from Norway to New Zealand, from Guiana to China and the shores of the Arctic Ocean. Where the stories themselves are not substantially identical, they often comprise single incidents which are the same, or, at all events, they embody the same principles, and are obviously sprung from similar processes of thought and similar conditions of human society. It is impossible to doubt that the stories collected by Ovid in his *Metamorphoses* were a portion of the serious belief of the peoples of Italy and Greece during many generations. To such peoples the transformation of a rat into a coachman and of mice into horses for Cinderella would have presented no more difficulty than to the Bororo of Central Brazil, who believe that they themselves after death become bright colored birds called araras; or to their neighbors the Bakairi, who hold that certain dreaded cannibal tribes have actually descended from a jaguar. The famous *Arabian Nights Entertainments* is another collection of folk-tales worked up by literary art.

In the United States the term folk-lore is usually applied to the tradition and myths of the Indians, and the recording of these has become an important part of ethnological research. The leading American anthropologists believe that the contents of myths are the safest records of the ideas and forms of thought obtainable from a primitive people. This is probably true for the Indian tribes, since in all their religious, philosophical, and social affairs they find authority and justification in their myths and folk-sayings. The Indian's ideas of his relation to the universe, his duty and his conduct, are expressed in the formulated myths that are handed down from one generation to the next. Some American anthropologists take the view that no records of myths and traditions are worth while unless written down phonetically in the original language in the form of what are known to students as texts. The contention is that the finer shades of thought and feeling are lost unless a literal translation is made, and that it is often these literary touches that convey the most important ideas of religion and philosophy. For this reason the Bureau of American Ethnology has taken a great many texts, a few of which have been published in their reports. The publications of the Jesup North Pacific Expedition contain texts and translations of the Kwaikutl and Haida Indians. In addition to this a large amount of Indian folklore has been published in free translation alone, and, notwithstanding the above noted objection, is an important contribution to anthropology. In 1888 the American Folklore Society was established, and in its journal and memoirs has recorded a mass of important material.

The literature of folklore is enormous. The following is a selection only:—Andrew Lang's *Custom and Myth* (1884), and *Myth, Ritual, and Religion* (2 vols. 1887; 2nd ed. 1899); J. G. Frazer's *The Golden Bough: a Study in Comparative Religion* (1890; 2d ed. 3 vols. 1900); Edwin Sidney Hartland's *The Legend of Perseus: a Study of Tradition in Story, Custom, and Belief* (3 vols. 1894, 1895, 1896); George Lawrence Gomme's *Ethnology in Folklore* (1892); Brinton's *Myths of the New World* (1896); Mooney's *Myths of the Cherokee* (1900); Swanton's *The Haida* (1905); Kroeber and Dorsey's *Traditions of the Arapaho* (1904); Boas' *Kwaikutl Texts* (1902).

Collections of American Indian myths may be found in the publications of the American Folklore Society, the American Museum of Natural History, the Field Museum of Natural History, the University of California, and the Bureau of American Ethnology.

Folks, Homer (1867), American sociologist, was born at Hanover, Mich., and graduated (1890) at Harvard. From 1890 to 1893 he was superintendent of the Children's Aid Society of Pennsylvania, then becoming secretary of the State Charities Aid Association of New York. Mr. Folks took an active interest in other local and national charity organizations, and in 1900 was called upon by the U. S. government to assist in reorganizing the public charities of Cuba. He was commissioner of charities of the city of New York from 1902 to 1904. His numerous papers include a *History of the Care of Destitute, Neglected and Delinquent Children in the U. S. during the Nineteenth Century* (1900). Mr. Folks became editor of the *Charities Review* in 1896.

Follen, Charles Theodore Christian (1795–1840), German-American educator, was born at Romrod, Hesse-Darmstadt, and graduated (1817) in law at the University of Giessen. He became professor of civil law at the University of Basel, Switzerland, but was driven away from Europe for his revolutionary opinions, and emigrated to the U. S. in 1824. He was associated as a teacher with Harvard College and Divinity School from 1825 to 1830, and was professor of German at Harvard from 1830 to 1835, subsequently filling Unitarian pulpits in New York city and Lexington, Mass., until his death on Long Island Sound, at the burning of the steamboat *Lexington*. See the Memoir, by his widow, in his *Works* (1841).

Follen, Eliza Lee (1787–1860), American author and reformer, was born in Boston, Mass., and was the daughter of Samuel Cabot of that city. She was married to Dr. Charles C. T. Follen in 1828, and, like him, took an active interest in the campaign against slavery. From 1843 to 1850 Mrs. Follen edited the *Child's Friend*. She prepared a memoir of her husband, and published, among other books, *Well-Spent Hours* (1827), *Poems on Occasional Topics* (1839), *Anti-Slavery Hymns and Songs* (1855), and *Home Dramas* (1859).

Follicle, in anatomy, a minute bag or secreting-recess in the body—*e.g.* a sebaceous follicle, secreting sebum, or a hair follicle, the cup or gland in which the hair is fixed, and from which a new one grows when the old one falls. Graafian follicles are the cystlike bodies embedded in the ovary and containing the ovum.

Folquet de Marseille (*c.* 1150–1231), Provençal troubadour, son of a Genoese merchant who settled at Marseilles. On his father's death he inherited a fortune; and Barral (Viscount of Marseilles), Raymond v. (Count of Toulouse), William viii. (Lord of Montpellier), and Richard Cœur de Lion vied with one another in doing him honor. The asceticism of his last years was in such strong contrast with the amorousness of his youth, that Dante placed him in the heaven of Venus (*Par.* ix.). Later he entered the order of the Cistercians, and became abbot of Le Toronet (1198), near Fréjus in Provence, and bishop of Toulouse (1205), where he died, having dis-

tinguished himself by his relentless persecution of all heretics, notably the Albigenses. After his death he was venerated almost as a saint. Some thirty of Folquet's poems are extant. Consult S. Stronski, *Le troubadour Folquet de Marseilles* (1910).

Fol'som, CHARLES (1794–1872), American scholar, was born in Exeter, N. H. He entered the navy as a chaplain, and was also instructor to the midshipmen in mathematics. In 1823–6 he was librarian at Harvard. Afterwards he superintended the publication of classical works for the college as a member of the publishing company of Folsom, Wells and Thurston. In 1833 he edited, with Andrews Norton, the *Select Journal of Foreign Periodical Literature.*

Foltz, JONATHAN MESSERSMITH (1810–77), American surgeon, born in Lancaster, Pa. He was commissioned Assistant Surgeon U.S.N. in 1831; Surgeon, 1838; Medical Director, 1871; and Chief of the Bureau of Medicine and Surgery, 1871. From 1832, when he witnessed the punishment of Malay pirates in Sumatra, his life was filled with lively experiences in all parts of the world, including bloody wars near the Rio de la Plata, the war between Mexico and the United States and the American Civil War. Consult C. S. Foltz, *Surgeon of the Seas* (1931).

Folwell, WILLIAM WATTS (1833–1929), American educator, was born at Romulus, N. Y. After several years of teaching he served from 1862 to 1865 in the 50th N. Y. Engineers during the Civil War. He then engaged in business until 1869, when he became president of the University of Minnesota, until 1884. In 1875 he was elected to the chair of political science and after 1907 was professor emeritus. He published *Minnesota, the North Star State* (1908); *History of Minnesota* (4 v., 1921–30). His *Autobiography and Letters* were edited by S. J. Buck (1933).

Fomalhaut, fō-ma-lō, (a PISCIS AUSTRALIS), a white star of 1.3 magnitude, intermediate in spectral type between Sirius and the sun. Fifteen times the solar luminosity is indicated for it by its parallax of 0.13″ (Gill), corresponding to a light-journey of twenty-five years.

Fomenta'tion, the therapeutic application of heat and moisture to affected parts of the body, as well as the substances thus applied. The simplest form consists of several thicknesses of flannel or similar material, which, after being dipped in boiling water, are wrung as dry as possible and laid smoothly over the affected part. Turpentine or opiates may be sprinkled over the flannel after it has been wrung, and hot boric or other antiseptic lotions may be used in place of water. Fomentations are employed in abdominal and thoracic pains, such as those of colic and pleurisy. They diminish tension, dilate the superficial blood-vessels, and, by increasing the blood supply of the tissues affected, sometimes resolve early inflammations and accelerate the processes of repair.

Fonblanque, fon-blangk', ALBANY WILLIAM (1793–1872), English journalist, first contributed to the *Times* and *Morning Chronicle;* then was connected with the *Examiner,* and eventually became its editor (1830–47). He republished some of his best articles under the title *England under Seven Administrations* (1837). Consult *Life and Labours of Albany Fonblanque* edited by his nephew (1874).

Fond du Lac, fon dōō-lak', city, Wisconsin, county seat of Fond du Lac county, at the head of Lake Winnebago, on the Chicago, Milwaukee, St. Paul and Pacific, the Chicago and Northwestern, the Minneapolis, St. Paul, and Saulte Ste. Marie Railroads; 60 m. N. W. of Milwaukee. It is an important railroad centre, situated in the heart of a rich agricultural and dairy belt. It has fine public buildings, business houses, churches and schools, a Carnegie Library and a hospital. There are summer resorts around the lake and a zoölogical garden in Lakeside Park. Lake steamers pass down Fox River and into Green Bay. The city has an airport. It has foundries and machine shops, re-

Some Notable English Baptismal Fonts

frigerator works, sash, door and blind factories, tanneries, machinery works and manufactories of typewriters, furniture, shoes, plows, wagons, awnings, and tents, shirts and overalls, fur coats, gasoline engines, caskets, paper boxes, boats, paint, and creamery supplies. Pop. (1930) 26,449; (1940) 27,156.

Fondi, town, Italy, Rome province; 12 miles N. W. of Formia. Via Appia forms its main street. Notable features are the chateau, San Pietro cathedral, the church of Santa Maria Assunta, and the Dominican monastery, containing a chapel in which Thomas Aquinas taught. The town was destroyed by the Turks in 1534 and in 1594. Pop. (1931) 13,320.

Fonsagrada, fôn-sä-grä'thä, town, Spain, province of Lugo, 75 miles northeast of Santiago. It is an agricultural centre, and has flour mills and linen manufactures. Pop. (1930) 17,896.

Fonseca, fôn-sä'kä, Gulf of, a gulf on the Pacific coast of Central America, 40 by 30 miles, between Salvador on the north and Nicaragua on the south. Its eastern shore is formed by Honduras, which thus has access to the Pacific. A U. S. naval base is located here. The port of Amapala is on Tigre Island in the bay.

Fonseca, Manoel Deodoro da (1827–92), Brazilian general, first president of Brazil, was born in Alagoas. He distinguished himself in the war (1865–70) against Montevideo and Paraguay, and later became the leader of the so-called 'liberals' or republicans, who came into power on the overthrow of the conservative Oliveira cabinet (1889). A revolution occurred, bloodless, thanks to Fonseca's humane principles; the emperor was declared deposed, and Fonseca became first president of the United States of Brazil (1891). Within six months he was deposed, and henceforth lived in retirement.

Font, the basin or receptacle for holding the water used in the rite of baptism, is usually composed of stone. The oldest are in Roman catacombs where shallow pools were hewn in the floor in which the neophyte stood. In the 4th century magnificent baptisteries enshrined the font which was a basin below the level of the floor or raised slightly by masonry, and large enough for several to be baptised within it simultaneously. The growing prevalence of infant baptism lead to a reduction in size and the elevation of the font. By the 13th century the usual font adapted to simple infusion was raised on piers or columns. The inside is often beautifully sculptured, the pedestal and exterior, of the basin being decorated, sometimes in relief and color, sometimes with gold. In the Roman Catholic churches, where the baptismal water is mingled with oil, the lining of the vessel is sometimes leaden. Usually the font stands at the western end of the church, but in some cases especially in European churches, it stands in a separate chapel or baptistery (q. v.)

Fontainebleau, fôn-ten-blō', town, France, in the department of Seine-et-Marne, near the Seine, 37 miles by rail S. E. of Paris. Its porcelain manufacture is important; and the town is especially famous for the palace, which was a residence of French sovereigns and dates from Francis I. When France agreed to an armistice in June 1940, Fontainebleau fell under German control. Pop. (1931) 17,075. The ***Forest of Fontainebleau*** covers an area of 65 sq. m. and is renowned for its varied scenery. The forest-village of Barbison has given its name to a school of painters (Corot, Millet, and others). See Barbison.

THE PALACE OF FONTAINEBLEAU

Fontana, fôn-tä'nä, Domenico (1543–1607), Italian architect. He was engaged to erect a chapel in the church of Santa Maria Maggiore, and to build the Villa Negroni at Rome, and was appointed papal architect by Sixtus v. During his tenure of office he built the Lateran Palace, the Quirinal, and the Vatican Library. After the death of Sixtus, Fontana was dismissed by Clement viii and went to Naples, where he erected many noble buildings.

Fontane, fon-tä'*ne*, Theo-

DOR (1819–98), German poet and novelist. After a journey to England in 1844, he settled down in Berlin and devoted himself to literary work. Of his old home he tells in his *Wanderungen durch die Mark Brandenburg* (1862–82), and of England and Scotland in four books. He is one of the best German writers of historical ballads, only the earliest of which show the influence of old English models. He is better known, however, as a writer of novels, of which the most important are *Vor dem Sturm* (1878); *Irrungen, Wirrungen* (1888); *Stine* (1890); *Frau Jenny Treibel* (1892); *Effi Briest* (1895), and *Der Stechlin* (1899). Fontane is a master of naturalism, but without pessimism, and combines shrewd observation and realistic description with refinement of style and even poetic qualities.

Fontanelle. See SKULL.

Fontanes, fôn-tān', LOUIS, MARQUIS DE (1757–1821), French poet and statesman, was born in Niort (Deux Sèvres). His first poems, *La forêt de Navarre* and *Le cri de mon cœur,* were published when he was only twenty-one. In the early days of the Revolution he edited the journal *Le Modérateur,* for which he was proscribed and obliged to keep in hiding, but after the fall of Robespierre he became a member of the Institute. After a short stay in London, where he enjoyed the friendship of Chateaubriand, he returned to Paris and championed the cause of Napoleon, at whose instance he wrote his fine *Eloge* on Washington. In 1808 he was appointed grand master of the Université and two years later entered the senate. After the restoration he was raised to the peerage. Among his other writings are *Le jour des morts* (based on Gray's Elegy); *Le verger; La chartreuse de Paris; Épître sur l'édit en faveur des non-catholiques.*

Fontanesia, fon-tā-nē'shi-ā, a genus of deciduous hardy and half-hardy shrubs belonging to the order *Oleaceæ.* It resembles the common privet, but has a rough bark and drooping branches. The foliage remains unchanged until late fall.

Fon'tara'bia, now FUENTERRABIA, town, Spain, in the province of Guipuzcoa; 10 miles northeast of San Sebastian. It is a quaint mediæval frontier town with a Gothic church of the 17th century and a picturesque castle dating from the 12th century. Pop. (1930) 6,181.

Fontenay-le-Comte, fon-t'-nā'-le-kônt', town, France, in the department of Vendée, on the river Vendée; 27 miles N. E. of La Rochelle. Its beautiful church of Nôtre Dame dates from the 15th to the 17th century, and the Chateau de Terre Neuve has collections of furniture and tapestry. The principal manufactures are hats, oil and soap. Pop. (1931) 1,581.

Fontenay-sous-Bois, sōō bwä', town, France, in the department of Seine, 6 miles east of Paris. There is a trade in wood and charcoal. Pop. (1931) 30,036.

Fontenelle, fôn-t'-nel', BERNARD LE BOUVIER DE (1657–1757), French writer and scientist, was born in Rouen and educated by the Jesuits in his native city. When quite young he began to contribute verses to the *Mercure Galant,* edited by his uncle, Thomas Corneille. In 1691 he was elected to the Academy despite the opposition of Boileau and Racine, and in 1699 was made secretary. This post he held until 1741, during which period he wrote the *Mémoires* and *Eloges* on deceased members, by many considered his finest work, and *Histoire du 'renouvellement de l'Académie des Sciences.* He collaborated on the operas *Psyche* and *Bellerophon.* Other important works were his *Apologie des tourbillons* and *Eléments de la géometrie de l'infini.*

Fontenoy, fôn-t'-nwä', village, Belgium, in Henegouwen or Hainaut province, 5 miles southeast of Tournai. On May 11, 1745, it was the scene of the defeat of the British and their allies, under the Duke of Cumberland, by the French, under Marshal Saxe. Pop. (1930) 854.

Fontes Villa, fon-tesh-vil'ä, town, Portuguese East Africa, on the Beira Railway; 34 miles northwest of Beira.

Fontevrault, fon'te-vrō' (by decree in 1928 the name became Fontevrault-l'Abbaye), town, France, in the department of Maine-et-Loire, in the forest of Fontevrault, 9 miles southeast of Saumur. It contains the ruins of a celebrated abbey, founded at the close of the eleventh century, by Robert d'Arbrissel, consisting of five churches, only one of which remains, a monastery, nunnery, and other buildings. It contained the tombs of several Plantagenet kings, but these have been demolished. Since 1804 the abbey buildings have been used as a prison. Pop. (1931) 1,581.

Fontinalis, fon-ti-nā'lis, a genus of aquatic mosses belonging to the family Polytrichaceæ, found in the temperate regions of both continents. They are thin-leaved plants, one to two feet long, rooting at the base only and growing attached to stones or roots of trees, in streams.

Foochau, fōō-chou', FU-CHAU, or FOOCHOW, a treaty port and capital of Fu-kien, China, lying about midway between Shanghai and Hong-kong, on the river Min, 34 miles from its mouth. The city has been greatly improved; the old walls are torn down and replaced by a wide motor road and the narrow streets have been widened. Motor buses connect Foochow with Nantai and Mamoi (Pagoda) and when bandits permit, with Amoy. The city has an electric light plant. It is connected with Chungchau Island by the *Bridge of 10,000 Ages,* of stone (1323); connecting Chungchau Island with the south bank of the Min, is the *Bridge in Front of the Granaries.* The Black Pagoda, built in 785, and White Pagoda, built in 903, are of interest. The Min Monastery, Moon Temple, and Kushan Monastery, in the vicinity, are fine specimens of Chinese architecture. The city makes the finest lacquerware, also silver jewelry in which kingfishers' feathers are inlaid, silk and woolen stuffs, goats' hair rugs and furniture. Camphor, paper, lumber, green tea, oranges and other fruits are exported. Formerly Foochow was one of the principal tea ports of China. After 1880 its trade and prosperity declined. Large vessels anchor at Pagoda Anchorage, 15 m. away, but the Min River Conservancy have dredged and drained the river and during 1934 some coasting vessels anchored at Foochow. In 1921 Fukien Christian University was founded in Foochau. In 1939 during the war between China and Japan, the University moved farther inland to Shaowu. According to the census of 1932, the population, with suburbs, was 346,992.

Food, the materials which the body uses to build and repair its tissues, to obtain energy for its activities, to regulate its processes, and to promote its growth and health. Foods are complex mixtures of various compounds which are thus classified: proteins, fats, carbohydrates, minerals, vitamins, and water. The proteins are the foodstuffs which contain nitrogen and comprise by far the greater part of the nitrogen-containing constituents of the food. The more familiar forms of protein are the muscle fibre of meat, the white of egg, gelatin, the curd of milk or cheese, and the gluten of flour or bread. The familiar forms of fat are butter, olive oil, lard, corn oil, cottonseed oil, and meat fat. The carbohydrates include

Food

starches and sugars. The cellulose or fibre of plant foods is also a carbohydrate but it is not utilized as food by the human being. The minerals are found in the non-combustible residue left when all the water has been driven off by heating and the dry residue burned. This ash is a mixture of inorganic or mineral substances. The vitamins are a group of important organic substances which are present in foods in such small amounts as not to be determinable by chemical analysis but which are nevertheless absolutely essential constituents of the human dietary. Water is present in most foods in relatively large amounts.

Food as bought at the market, or even as served on the table, also contains more or less of materials which are usually not eaten, such as the bones of meat and fish, the shells of eggs and nuts, and the skins and seeds of fruits and vegetables. These are known as *refuse*.

The values of different foods as fuel are generally obtained in the chemical laboratory by means of an apparatus called the bomb calorimeter, which measures the amount of heat given off by a known quantiy of the material when completely oxidized. This value is called its heat of combustion, and is taken as a measure of its latent or potential energy. The unit used is the *Calorie*, the amount of heat required to raise the temperature of a kilogram of water one degree centigrade. From such determinations has been ascertained the amount of energy available to the body—that is, the 'fuel value'—for the different nutrients. Thus protein and carbohydrates each yield about 4 calories per gram and fat 9 calories per gram. The composition of a few common foods is given in a table published by the U. S. Department of Agriculture in its Bulletin 28 (Office of Experiment Stations), revised periodically. In brief it may be said that meats, fish, eggs, fresh vegetables, and fruits contain the most refuse and water; that protein is most abundant in the animal foods and legumes, and occurs in considerable quantities in the cereals; that fats occur principally in the animal foods and nuts, and carbohydrates almost exclusively in the fruits and vegetables, cereals and milk; and that small quantities of mineral matter are found in almost all food materials.

Foods are not all digested with equal completeness. (See DIGESTION.) The nutritive value of a food depends on its digestibility as well as on its composition. Many experiments have been made to test the proportions of nutrients digested from ordinary food materials. From the results of such experiments it has been found that most foods used by man are almost completely digested. In the total food of an ordinary mixed diet, on an average about 92 per cent of the protein, 95 per cent of the fat, 98 per cent of the carbohydrates, and 75 per cent of the ash are digested and utilized by the body. Animal foods are more completely digestible than vegetable—about 97 per cent of the protein, 95 per cent of the fat, and 98 per cent of the carbohydrates of the animal foods being digested, as opposed to 83 per cent of the protein, 90 per cent of the fat, and about 95 per cent of the carbohydrates of vegetable origin.

As to agreement of foods with individuals, it may be stated that some persons are differently constituted from the great majority, and have idiosyncrasies respecting foods. Cases in which wholesome foods are hurtful to individuals are numerous; but such cases are due to an abnormal sensitiveness and not to the food.

The food finally absorbed into the system functions in three different ways: (1) to yield energy, (2) to build tissue, and (3) to regulate body processes. It must not be thought that any one food substance functions in some one of these three ways and no other. Protein digestion products, for example, may both furnish energy and build tissue while phosphates are used both to build tissue and to help regulate the neutrality of the blood.

Water furnishes 60 to 70 per cent of the weight of the body. It is therefore indispensable as a component of the tissues, but it also plays a very important rôle in regulating body temperature. The sources of energy in the body are the fats, proteins, and carbohydrates. Fat is formed in the metabolism of foods, and this may be stored in the body as reserve fuel. Protein is the principal food for building up and repairing the muscles and tendons, and supplying the nitrogenous portions of blood, milk, and other fluids. Protein can also be transformed in the body into fat and carbohydrate, while it supplies the body with the same amount of energy per unit of weight as the carbohydrates. Therefore the different nutrients can do one another's work to a greater or less extent. If the body has not enough of one kind of fuel, it can use another. Neither fats nor carbohydrates, however, can take the place of protein in building and repairing nitrogenous tissues, or be changed into it.

For persons in good health and with normal digestion it is important to use such kinds and amounts of food as will supply all the nutrients that the body needs, and at the same time avoid burdening it with superfluous material to be disposed of at the cost of health and strength.

Nevertheless, a cardinal principle of rational nutrition is the requirement of a small amount of good food above the average actual need of the body. This furnishes a margin of safety to protect the body in times of stress.

A diet supplying one gram of protein per day per kilogram of body weight for adults has been recommended. This allows more than 50 per cent above the requirement as a margin of safety. To this must be added sufficient fat and carbohydrate to coincide with the total energy expenditure—approximately 2,800 calories per day. The amount of fat which a person carries indicates rather closely whether the food is correctly adjusted to the energy requirement of the individual. But since the expenditure of energy increases with an increase of body weight, a more liberal diet may be necessary for the heavier body and the added fat up to a certain point may be of great value in any unusual strain. Pronounced underweight up to 25 years of age is unfavorable, but overweight after 35 years of age is associated with a high death rate; after middle life it is a health menace. The amount of food required to maintain health varies enormously with extremes of muscular activity, age and size. What is normal varies with different economic and racial groups and with individual build, so that a comparison of a child's weight with published standards, while giving a fair idea of his nutritional condition, may not be conclusive. A normal rate of growth is more significant. Besides furnishing calories and protein the diet must also contain enough of the right kinds of minerals and a sufficient supply of vitamins. A liberal use of milk, vegetables, and fruits will insure the securing of these latter two essentials of an adequate diet.

Other things being equal, foods that furnish nutrients which can be easily and completely utilized by the body are most desirable. The question of the preparation of food is therefore of importance. Many articles which, owing to their mechanical condition, are quite

unfit for nourishment when raw, are very nutritious when cooked. A well cooked food may also be wholesome and appetizing, while the same material badly cooked may be unpalatable. Cooking has three chief objects. The first is to change the mechanical condition so that digestive juices can act on the food more freely. Heating often changes the structure of food materials greatly, so that they are more easily chewed and more easily and thoroughly digested. The second is to improve the appearance or flavor, and so make it more appetizing. Food which is toothsome quickens the flow of saliva and other digestive juices, and so digestion is aided. The third object is to kill by heat any disease germs, parasites, or other dangerous organisms the food may contain. The following bad influences of cooking must be noted: overcooking may toughen foods, destroy vitamins, and develop substances injurious to health; inorganic salts in meats, fruits, and vegetables may be lost in the cooking water; fibrous foods (cereals, vegetables, especially legumes) if under-cooked may be irritating to the digestive tract and hard to digest; proteins cooked at too high a temperature become leathery and hence indigestible; too fatty foods (gravies, pastries, fried foods) are indigestible and fat heated at too high a temperature forms irritating products; carbohydrates, if insufficiently cooked, may contain grains that cannot be ruptured or soft balls which digestive fluids cannot penetrate. (See COOKERY).

Cost of Food.—Though this makes up from 40 to 60 per cent of the living expenses of the great majority of people, there is little knowledge, even among the intelligent, of the relative economy of different foods. The cheapest food is that which supplies the most nutriment for the least money; the most economical food is that which is cheapest and at the same time best adapted to the needs of the user.

The market price affords very little guide to the economy of food, since it is determined by considerations other than that of nutritive value such as the amount of labor and price of materials required for production; the costs of packing, transportation, and cold storage; and other factors. Aside from these legitimate charges, the price may be inflated by the profits of speculators and illegitimate middlemen; by waste on the farm; by large losses in transit because of lack of proper grading, packing and standardizing; and by inefficient methods of distribution. To the market cost the housewife must add the cost of fuel and the labor required in preparing the food for the table.

Under ordinary conditions the plain, substantial standard food materials, such as the cheaper cuts of meat and fish, milk, flour, cornmeal, oatmeal, beans, and potatoes, are the most economical. They are also as digestible and nutritious, and as well fitted for the nourishment of people in good health, as the costlier materials. In general, it may be said that the cereals, such as wheat, Indian corn, oats, rye, and barley, are the cheapest and best balanced foods. When, however, these have been manipulated by roasting, mashing, and milling, they are often offered at fictitious prices—from five to ten times their real value. These cereals should be offered to the consumer with the least possible manipulation.

In order to make the best use of food it is helpful to know just what individual foods contribute to the diet. At the present time they may be grouped as follows for this purpose:—(1) sugars and starchy foods, (2) fatty foods, (3) protein-rich foods, and (4) fruits and vegetables. Sugars lack proteins, mineral salts and vitamins; are irritating to the lining of the alimentary tract; may ferment in the body causing gas; lead to lack of appetite for needed foods. Starches (grain products and starchy vegetables) are an economical source of energy and protein. At least 60 per cent of our food calories should be carbohydrates, mostly grain products. To supplement carbohydrates, milk, fruits and vegetables are needed. Protein is a valuable part of the diet but it is not needed in large amounts. A medium-sized serving of one protein-rich food (not including milk) is recommended in each meal. Milk and eggs furnish complete proteins and are specially adapted to growing children. By complete proteins is meant those which contain all the amino acids needed to provide for growth and maintenance of the body. The incomplete proteins are chiefly in vegetable foods. Grains and legumes are the most economical sources of protein. Fruits and vegetables are valuable for their pleasing taste and because they are excellent sources of mineral salts and vitamins; they also give needed bulk in the diet. Thus their effect on health is shown in their influence on appetite and digestion, on intestinal hygiene, on the acid-base equilibrium of the body, and its vitality and resistance to disease. Fruits and vegetables (with milk) are our best alkalinizers. Bodily vigor depends somewhat upon its 'alkali reserve' and upon a liberal supply of vitamins.

Perhaps the safest, simple guide to choosing one's food is found in two 'rules' suggested by Sherman for the expenditure of food money. (1) At least as much should be spent for milk (including cream and cheese if used) as for meats, poultry, and fish, and (2) At least as much should be spent for fruits and vegetables as for meats, poultry, and fish. These rules have been found to work satisfactorily whatever the level of food expenditure may be.

Food and Health.—In general the 'protective foods' are milk, vegetables, fruits, and grains. These protective foods supply elements which are necessary to the diet, but which are most apt to be lacking. That is they supply mineral elements, especially iron and calcium, vitamins, especially A, C, and D, roughage, and base-forming foods.

An adequate diet for each person daily includes enough fuel, protein, mineral salts and vitamins to maintain weight and avoid disease and enough roughage to avoid constipation: 1 pt. to 1 qt. of milk; fruit twice daily, succulent vegetables at least twice daily, leafy ones at least three times a week; salad (raw) at least once, preferably twice daily. It is desirable to add to the day's menu one whole grain food, one serving of potato, one serving of meat, one egg, and butter. In the optimal diet, fats and proteins are moderate in amounts and there is an excess of mineral salts, of vitamins, and of base forming foods.

The chief things to aim for in a reducing diet are: a low caloric content (very important), relatively high protein content, moderately low carbohydrate content, very low fat content; and good satiety value. Foods to use include clear soups, tea, and coffee, milk, especially skim milk or buttermilk, fresh fruits and stewed fruits without sugar, watery and fibrous vegetables, lean meat, eggs and soft cheese, a little simple dessert. The addition of a few carbohydrates as bread, potatoes, prevents hunger. An upbuilding diet includes a high energy intake, moderate amounts of high quality proteins, an abundance of mineral elements, vitamins and fiber. Foods to use include butter, cream, salad dressings, bacon, cereals, sugar, bread, cream soups, and high calorie desserts,

nuts, dried fruits, legumes. The diet should provide at least 500–1,000 calories surplus of intake. A person needing normally 2,100 calories should take 2,800 to 3,500 calories when upbuilding.

It is difficult to get all the elements needed by the body, especially calcium, iron, fat-soluble vitamins and complete proteins, unless some animal food is taken, or excessive amounts of leafy vegetables. By adding milk, cheese, and eggs, these essential elements are added to the diet. However, meats are easily digested and appetizing. An excess of them may produce intestinal putrefaction, too many nitrogenous waste products, especially uric acid, and an acid condition of the body.

Food Investigations.—Respiration calorimeters have been constructed and operated the main feature of which is a copper-walled chamber about 7 ft. long, 4 ft. wide, and 6 ft. high, fitted with devices for maintaining and measuring a ventilating current of air, for sampling and analyzing this air, for removing and measuring the heat given off within the chamber, and for passing food and other articles in and out. It is furnished with a folding bed, chair, and table, with scales, and with appliances for muscular work, and has telephone connection with the outside. Here the subject stays from one to fourteen days, during which time careful analyses and measurements are made of all material which enters the body in the shape of food, and of all which leaves it in the breath and excreta. A record is also kept of the energy given off from the body, as heat and muscular work. With such apparatus it is possible to learn what effect different conditions of diet, etc., have on the human body.

More recently food investigation has been largely carried on by means of feeding experiments with laboratory animals. This method of food investigation got its impetus from the discovery of vitamins which occur in foods in such small amounts as not to be detected by the methods of chemical analysis but which are absolutely necessary to normal nutrition in both animals and human beings. Consequently feeding experiments with laboratory animals have been used as the means of determining the relative values of foods as sources of the vitamins. This type of experimentation has also been increasingly used to investigate other differences among foods such as the differing efficiencies of the proteins in promoting growth, the effects of many dietary deficiencies, and the effectiveness of different combinations of foods in supporting normal nutrition.

Nutritive values of proteins are believed to depend upon the kinds and proportions of amino acid radicals which they contain, about a score of which are known. Experimentation to determine their nutritional function is an important field of food investigation. It is known that at least four (cystene, histidine, lysine, and tryptophane), must be supplied to the body by food.

See ADULTERATION; CHILD; COOKERY; DIET AND DIETETICS; DIGESTION; FOOD CONTROL; NUTRITION; PURE FOOD AND DRUG LAW.

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Food Adulteration. See ADULTERATION; PURE FOOD and DRUG LAW; MEAT, *Government Inspection*.

Food Control, the governmental regulation of the production and distribution of foodstuffs, including national and State laws to prevent the adulteration and improper labelling of foods, as well as special legislation for the conservation of food supplies in war time. The subject of pure food and drug legislation is treated elsewhere in this work (see ADULTERATION; PURE FOOD AND DRUG LAW); the present article deals with the more stringent applications of the principles of food control in the nations involved in the first and second World Wars. Food control is a necessary measure for the conservation of human resources during periods of economic scarcity.

Germany, in the first World War, facing a serious shortage in food because of the British blockade, established maximum wholesale and retail prices, issuance of food tickets, observance of meatless days, and many other detailed regulations of the consumption of food. In Great Britain a Royal Commission on the Sugar Supply, a Royal Wheat Ministry, and a Food Ministry (1917) were formed, which limited supplies of essential foodstuffs to retailers and restaurants; finally maximum prices and a rationing system were introduced. In the United States the Council on National Defense appointed a Committee on Food Supply and Prices headed by Herbert Hoover. The Food Administration Bill of 1917 provided for governmental control of foods and of machinery used in the production of foods. All countries affected by the War established at least a limitation upon food exports, and many went much farther in the controls they used.

Food control for the second World War started long before the war began. The Russian state had a highly centralized system of price and food controls; rationing and food cards, hitherto measures reserved for wartime, were installed for many years as a normal part of the national economy. As soon as Germany began to rearm with Hitler at the head of the government, many regulations of the production, distribution, and consumption of foods were imposed. Waste was curtailed and compulsory labor employed to increase the degree of self sufficiency. Goering proclaimed, 'Butter makes us fat; cannon make us strong.' Therefore, when the war came in 1939, the German economy was already on a militaristic basis and capable of more decisive action than the Allied economies, which had to be painfully adjusted to the new situation in short order. Curtailment of the consumption of essential products took place at a much earlier time than in the first World War, and the blockade of supplies to the European continent was pressed more vigorously by the British fleet.

As a result, the whole continent had to undergo rationing of most necessary foods.

Foods, Preserved, foods which have been manipulated to ensure their keeping for long periods. Of this class the best known are those to which is applied the name of canned or tinned meats, fruits and vegetables. The curing and drying of hams and fish by means of a brine pickle, with or without smoke, had long been practised, as has the preserving of fruits with sugar; but the preparation of preserved food in a handy, portable form is an industry of comparatively recent growth. Condiments such as salt, sugar, spice, vinegar, and wood smoke have incidental preserving qualities. The principal methods now in common use are (1) sterilization, (2) desiccation, (3) refrigeration, (4) curing in con-

nection with condimental substances. Where foods are preserved by heating, the ferments which occur in the substance and micro-organisms are entirely destroyed, whereas the action of cold hinders their development. Drying preserves fruit by diminishing the water content below that required for the development of micro-organisms. (See FRUIT, EVAPORATED).

Sterilization, or preservation by heat, is generally considered the best method and is the one most commonly used both commercially and in home preserving. This method was discovered in 1795 by Nicholas Appert, a Frenchman, who enclosed fruit, after heating it, in a glass bottle, which he then corked and subjected to the action of boiling water. It was introduced into England in 1807 and into the United States in 1819.

There are two methods of canning commonly used both in the factory and in the household. They are known as the open-kettle method and the cold-pack method. In the open-kettle method the food to be canned is completely cooked in a kettle and then poured into the jar or tin. In the cold-pack method, the uncooked or partly cooked food is packed in a can or jar, it is covered with liquid—water, juice, or sirup—and the jar with its contents is heated in boiling water or steam.

Desiccation, dehydration, or *drying,* is the oldest and most primitive method for the preservation of food. It does not injure the nutritive value of food, and, if it is properly done, much of the natural flavor is retained. Apples, corn, lima beans, string beans, peas, squash, pumpkins, peaches, apricots, and plums can be dried successfully. Meats and fish are often dried after a preliminary smoking or salting.

Refrigeration does not kill micro-organisms, but it arrests their growth and is, therefore, an efficient method of preserving food for a limited period. (See REFRIGERATION; PACKING INDUSTRY).

The preservation of food by the use of *condiments,* such as salt, vinegar, and spices, depends upon the fact that bacteria and yeast cannot grow successfully in the presence of these substances. Among the methods employed are dry salting, salting in brine, and pickling in vinegar. (See PICKLING).

Meats and fish are often preserved by wood smoke and eggs by coating the shell, with such substances as boiled oil and water glass so as to exclude the air, or by immersion in lime water and subsequent drying.

Evaporated or condensed milk is milk from which a large part of the water has been removed and the residue sterilized in air-tight cans. (See DAIRYING).

The vitamin value of foods is apt to be less in preserved foods. This is especially true for Vitamin C. Food preservatives are sometimes added to cover up inferior qualities of food. Under the farm-products grading law, the Secretary may promulgate grade standards for canned goods. Grades are designated as Grade A (fancy), Grade B (extra standard or choice), Grade C (standard), Offgrade (substandard). When consumers refuse to buy ungraded products, canners will be driven to label according to these grades.

Consult J. H. Collins, *Story of Canned Foods,* (1924); T. N. Morris, *Principles of Fruit Preservation* (1933).

Fool. See JESTER.

Foolscap, writing paper varying in size from 12×15 to 13½ ×17 in. Double foolscap is 17 ×27 in. It is so called from the former watermark—a fool's head and cap.

Fool's Parsley (*Æthusa Cynapium*), a slender annual umbelliferous plant somewhat resembling parsley and having doubly pinnate, dark-green leaves, and terminal, compound umbels of white flowers in late summer. There are no bracts at the base of the large or general umbel; but at the base of each small or partial umbel are three long, narrow leaves on the outside, which serve to distinguish this plant from all others. Fool's parsley is a naturalized weed, usually growing about ten inches in height, and is poisonous.

Foot, the lower extremity of the leg in man or animal, on which it rests or moves in walking. The skeleton of the human

Skeleton of Human Foot.

foot consists of three divisions: the tarsus, metatarsus, and phalanges. There are seven bones in the tarsus: the *os calcis,* the largest and strongest, situated at the back of the foot and forming a strong lever for the muscles of the calf; the *astragalus,* the next largest, occupying the middle and upper part of the tarsus, resting partly upon the os calcis and supporting the tibia and fibula; the *cuboid,* on the outer side of the foot, in front of the os calcis and behind the fourth and fifth metatarsal bones; the *scaphoid,* at the inner side of the tarsus, in front of the astragalus and back of the *three cuneiform bones* which complete the bones of the tarsus. These three cuneiform bones, the internal, middle, and external, are all wedge-shaped and, with the cuboid, articulate with the metatarsal bones.

The metatarsal bones, five in number, are long bones, each divided into a shaft and two extremities. The first is the shortest of all but much larger than the other four. Each metatarsal bone articulates at one end with the first row of phalanges and at the other with the tarsal bones.

The phalanges, two in the great toe and three in each of the others, resemble those in the hand. Those in the second row are short and small but somewhat broader than those in the first row.

The seven tarsal and five metatarsal bones are so arranged and connected that they form the plantar arch, from the extremity of the heel to the balls of the toes. The astragalus forms the keystone of this arch and transmits the weight it receives back to the heel or forward to the toes.

Human feet, compared with those of other mammals, present peculiarities due to man's erect position. In cattle and horses the toes are fewer and the nails or claws are developed into a single hoof. In the cat family, as well as in some other animals, there is a tendency towards a rudimentary inner toe, and the ball of the foot is much more developed than the heel.

The principal diseases and deformities of the foot are touched upon in separate articles—e.g., CLUB-FOOT. The toes may be deficient (congenitally) in a joint, or the number of toes may be greater or less than ordinary, or they may be more or less webbed. These congenital deformities are sometimes hereditary. The astragalus sometimes descends slightly below its proper level, causing what is known as 'weak angle'; if the defect is decided it causes 'flat-foot' (q. v.). Bunions and corns (qq. v.) are common deformities. Consult H. Gray, *Anatomy of the Human body.*

Foot, a measure containing twelve inches, so called from its being taken roughly as the length of a man's foot. A *square foot* is a square whose side is one foot and which therefore contains 144 square inches. A *cubic foot* is a cube whose side is one foot, and

which has a volume of 1,728 cubic inches. See WEIGHTS AND MEASURES.

Foot and Mouth Disease, APHTHA, or APHTHOUS FEVER, a highly contagious acute fever of a specific nature, characterized by the eruption of vesicles or blisters in the mouth, around the coronets of the feet, and between the toes. It is essentially a disease of cattle, but it also attacks hogs, sheep, goats, buffalo, deer, horses, cats, dogs, and poultry. It occurs rarely in man, chiefly in children and adults who handle sick animals. It is extremely prevalent in European countries, where it causes great economic loss. Outbreaks in America, occurring in 1870, 1880, 1884, 1902–3, and 1908, have been quickly suppressed.

Foot and mouth disease is caused by a specific virus occurring in the serum of the vesicles on the mouth, feet, and udders, in the saliva, milk and other secretions, in the excreta, and in the blood during the rise in temperature. Infection may take place directly, as by licking and sucking, or indirectly through infected manure, hay, utensils, drinking troughs, barnyards, etc. The same animal may be attacked repeatedly.

The disease appears in three to six days after exposure and is indicated by a chill followed by high fever. In one or two days small vesicles about the size of a pea appear on the mouth, and swelling, redness, and tenderness are manifest about the feet. In milch cows the udder and teats also show vesicles. The attack lasts normally from ten to twenty days, but has been known to continue for nearly a year. The mortality is not great, generally from 1 to 3 per cent. Consult *Circulars 141* and *147* of the U. S. Bureau of Animal Industry.

Foota-Toro. See FUTA-TORO.

Football is a game played between two contesting sides, each of which endeavors to kick or carry the ball across the goal line of the opponents. It is played with a ball sometimes round, sometimes oblong, and by teams varying from eleven to twenty men. There are two branches of the early root of football—the Association and Rugby; but these have various subdivisions, and probably the three games most widely recognized to-day are the British Association, the Rugby Union, and the American Intercollegiate. Of these, the British Association is a game in which the ball is propelled only with the feet, and may not be carried; while the Rugby Union rules admit of the ball being carried in the arms, as well as thrown and kicked; they also admit of tackling the runner. The American Intercollegiate game is the direct outgrowth of the Rugby Union. The rules of the Rugby Union were adopted in America in the fall of 1876, and at the time were taken over *in toto*. Since then they have been modified until the American Intercollegiate is a peculiarly scientific game of its own, its principal development being along the lines of off-side interference. The only other game growing out of the Rugby Union rules that has made much headway is the Australian game, which is less rough, owing to the rules forbidding tackling and the method by which the ball may be advanced. Great Britain's various colonies have also modified the strict Rugby Union rules somewhat, the games of Canada and of New Zealand differing not a little, though both are derived from the parent stem.

Modern football is a direct descendant of the ancient Roman game of *harpastum*, in which the object of the players on each side was to seize the ball and carry it, by some means or other, across a line marked on the ground in the rear of their opponents. The pastime was probably introduced into Britain at the commencement of the Christian era.

American Intercollegiate Football.—The only game of football that has obtained much footing in America is the college game. The Association, Rugby, and other games have been and are played occasionally, but their adherents and the number of spectators are comparatively few, while in the college games as many as 80,000 spectators have watched rival teams in important matches. The college game is confined almost exclusively to colleges and schools, although some athletic clubs have attempted to play games with elevens made up of college graduates, and there has been some professional football in certain sections. The present game is a development of the English Rugby modified to meet the demands of the American temperament, which asks for more definiteness and an opportunity for greater planning than that afforded by the parent game. For some years after its adoption, the game was changed in material points, and the rules were annually revised by meetings of captains and managers. Later, annual conventions took the place of these meetings. At the present time a Rules Committee makes annual revisions of the rules as the development of the game demands, but largely preserving the principles of play and balancing the attack and defence.

The line-up finally settled down to eleven men, as follows: Seven forwards—composed of left end, left tackle, left guard, centre, right guard, right tackle, and right end; and a quarterback, two half-backs, and a full-back behind the line. At first the method of play was simple. When a side was on the offensive, the line men of the opposing sides formed across the field, facing each other and close together; the quarterback was brought close behind the centre, and the halves and full-back behind him. On the defence, one of the backs was sent far behind the line to look after any kicks which might be made by the offence. The ball was placed on the ground by the centre, the men lined up against each other, and at a given signal the centre snapped the ball back to the quarter, who in turn passed it to one of the backs, who tried to gain ground with the ball in his hands. If he was about to be tackled he passed the ball to another player of his side—and so on until the player with the ball had been tackled and his progress stopped. No player was allowed to tackle or interfere with a player of the opposite side unless that player had the ball. Each line-up or scrimmage was called a 'down,' and after a few years a rule was enacted providing that if a side failed to make five yards toward its opponent's goal in three downs, or to retreat twenty yards, it had to surrender the ball, or kick it over toward the opponent's goal on the third down.

About this time, also, off-side interference made its appearance. That is, players on the same side as the man running with the ball were allowed to run ahead of him, or alongside, and ward off, by blocking with their bodies, the opponents who were trying to get at the runner and stop his progress. The man in the scrimmage line charged forward when the ball was snapped back, and opened a hole in the opposing line for the runner to get through, attended by his interferers, and thus the whole plan of the game was materially changed. From this it was only a step to the famous flying-wedge, invented by Lorin F. Deland, of Harvard, which provided that some of the line men should join with the backs several yards behind the line and form a 'V'-shaped mass of players, which started when the ball was snapped back, with the runner within the 'V.' The wedge went down the field like a charge of cavalry, scattering destruction in its tracks. It was the acme of the momentum mass play.

The flying-wedge lasted only a year, for the outburst of public condemnation of it was enor-

Football

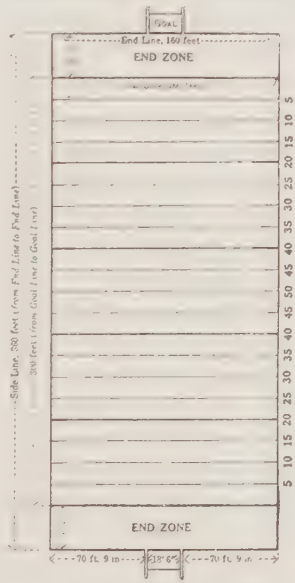
mous. To regulate the game and to prevent dangerous plays, the University Athletic Club made up a football rules committee which, although it had no real power, enforced its rules upon all colleges. In the fall of 1905 there was a general outcry against the brutality of the game, and several universities refused to allow their students to play it at all. A meeting of two score or more of the colleges not represented on the Rules Committee was called in New York City, and a new rules committee was appointed. After some discussion the old committee concluded to join with the new one, and the rules for 1906 were made. This amalgamation of committees has since been continued. The Rules Committee is now appointed annually by the National Collegiate Athletic Association.

At that time (1906) several radical changes were made in the rules, the principal ones being the requirement of a ten-yard gain in four downs, instead of five yards in three downs; the introduction of the forward pass; the separation of the scrimmage lines, and general rules legislating more strictly against roughness. At the same time provision was made for a board of officials who should control umpires, referees, field judges, and time-keepers.

Following this revision, certain other changes were made, not very material the second year, and rather more sweeping the third year. By the time the season of 1909 was finished, however, it had become evident that the introduction of the forward pass had brought about a condition in which the pass itself was little used, but the heaviest and most atrocious mass plays ever known in the game were introduced, and the pounding of the player occupying the position in the line known as 'tackle' was so severe that serious injuries sometimes resulted. This brought about another radical revision in 1910, when the Rules Committee legislated against the pushing and pulling of the runner, and also against any interlocked interference. They also protected the receiver of a forward pass, for it had become manifest that the ends—the usual recipients of this pass—were being decimated as the season progressed. They also permitted the forward pass and the quarter-back run to be made anywhere across the line of scrimmage, provided the passer was five yards back of the line. The rules regarding pushing and pulling and interlocked interference had been found absolutely necessary, and during the season of 1910–11 resulted in minimizing that serious feature.

The Rules Committee has thus been able from time to time to make such changes in the laws as shall cut out undesirable tendencies and still preserve the general character of the American Intercollegiate game, which is one of wonderful possibilities in the way of tactics, generalship, and organization.

Method of Play.—The game is played on a rectangular field 300–360 feet long (of which 30 feet at each end is behind the goal line, forming the 'end zone,' so-called) and 160 feet wide, enclosed by heavy white lines marked in lime upon the ground.


Goal
End Line, 160 feet
END ZONE
Side Line, 300 feet (from End Line to End Line)
300 feet (from Goal Line to Goal Line)
END ZONE
70 ft. 9 in.
160 ft.
70 ft. 9 in.

American Intercollegiate Football: Field of Play

The lines thus 30 feet from each end are called the goal lines. The goal is placed in the middle of the end lines, and consists of two upright posts exceeding 20 feet in height, and placed 18 feet 6 inches apart, with a horizontal bar 10 feet above the ground. The football used is made of leather, enclosing an inflated rubber bladder, and has the shape of a prolate spheroid. The field is marked off with white lines every five yards parallel with the goal line.

The ball is put in play by a kick 40 yards out from the kicking side's goal-line, and the player receiving it runs toward his opponent's goal-line until he is stopped or his progress impeded, when a scrimmage line is formed where he was stopped: the centres, guards, and tackles facing one another, the length of the ball apart, while the ends are some distance away from the five men, but not forward of the scrimmage line. The ball is then placed on the ground in front of the centre man, and the quarter-back stands behind him to receive it and pass it to the man who is to run with it. The quarter-back may also run with it. What is called the 'direct pass' is also used, whereby the ball goes from the centre direct to the runner, without being handled by the quarter-back. Forward passes may be made from at least 5 yards behind the scrimmage line, but after the second consecutive incomplete pass, a penalty is imposed.

When the runner receives the ball his fellow players in the scrimmage line attempt (but without use of hands or arms) to make openings through the opponent's line for him to get through, and he is also aided by team interference, which starts simultaneously with him. Unless a side makes ten yards toward its opponent's goal-line in four downs it must surrender the ball. It is usual on the third down, when the needed gain seems unlikely, for the centre to pass the ball direct to the full-back for a punt down the field toward his opponent's goal. When this punt is recovered by an opponent he may elect to run with it or return the kick. It is usual, however, for the man who gets the ball to run with it.

The game proceeds in this way until one side or the other has rushed the ball over its opponent's goal-line or time is up. When the ball has been rushed over the goal-line it is called a touchdown and scores six points. A team which has made a touchdown is allowed to try for an additional point by putting the ball in play by a scrimmage on the five-yard line. One play only is permitted in which to score the extra point and this may be accomplished either by kicking a goal from the field, or by again carrying the ball across the opponent's goal-line or by completing a forward pass in the opponent's end zone. A goal from the field counts three points, and is made by a drop-kick or field kick from placement from any part of the field in front of the goal line, and it may be made at any time while the ball is in play. A safety which scores two points for the opponents, is made whenever the ball is declared dead in possession of a team behind its own goal-line, provided the impetus which carried it across the goal line came from the team defending that goal. If the impetus which carried the ball across the goal-line was given by an opponent, it is a touchback which carries with it no score.

A drop-kick is made by letting the ball drop from the hands and kicking it the instant it rises

from the ground. A punt is made by letting the ball drop from the hands and kicking it before it touches the ground. A place-kick is made by kicking the ball after it has been placed on the ground. A kick-off is made by a place-kick from the 40-yard line, and a goal cannot be made from it or from a punt. A team which has scored a safety puts the ball in play by a free kick from its own 20-yard line. A team which has made a touchback puts the ball in play by a scrimmage from its 20-yard line. A free kick is any kick when the opponents are restrained by rule from advancing beyond a certain point before the ball is put in play. A side which has made a touchback or a safety must kick out or scrimmage the ball from not more than 20 yards from the kicker's goal. When a ball is kicked over the side lines it goes to the kicker's opponents at the point where it went over the line, except on the kick-off, when a ball sent over the side lines must be kicked again; and if the second kick-off goes over the side-line, it is again returned to its initial position. If the ball is kicked into the end zone, it reverts to the 20-yard line.

In 1927 the Rules Committee felt that the game would be benefited by further 'opening up' the play and by minimizing the too close concentration of players. To accomplish this the rules were amended so that when the ball is passed backward or fumbled and recovered by an opponent after striking the ground it is dead at the point of recovery.

This change was to encourage greater freedom in handling the ball and spread the defence, making the game even more interesting to spectators and a greater test of skill to players.

The officials are the referee, who has general oversight and control of the game and who is sole authority for the score; the umpire, who has primary jurisdiction over the equipment, conduct and positions of the players; the field judge, who has primary jurisdiction over the timing of the game, and the linesman, who under supervision of the referee and with the aid of two assistants marks the progress of the ball.

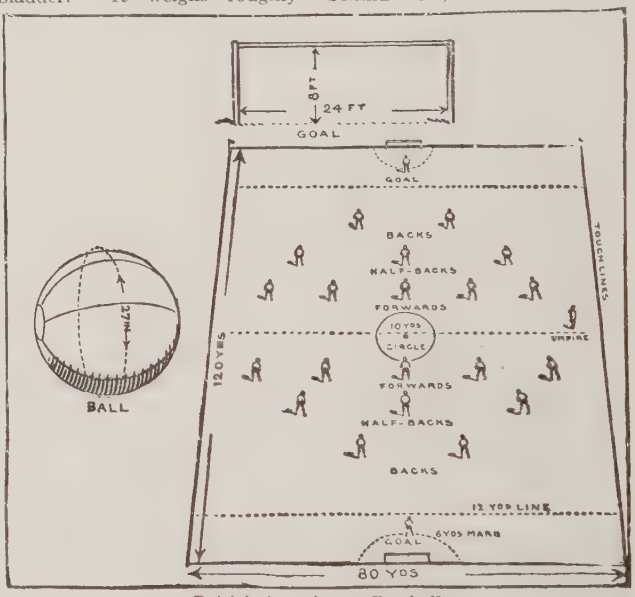
All four officials have concurrent jurisdiction over fouls and infractions of the rules, the referee being the final judge in the event of conflict in opinion or testimony. It is also his duty to enforce the proper penalties for violations of the rules, which vary from loss of a distance of five yards to disqualification of a player and loss of one-half the distance to the goal-line, depending upon the nature of the offence, brutality being most severely punished.

The time of the game is sixty minutes, divided into two halves of thirty minutes each, with fifteen minutes' intermission, each of these halves being further subdivided by an intermission of one minute, thus making four fifteen-minute periods. The side making the largest score in the two halves is the winner.

Association Football.—In association football the object of each team is to send the ball through its opponent's goal, between the uprights and *below* the cross-bar. The ball is spherical in shape, must not be less than twenty-seven nor more than twenty-eight inches in circumference, and consists of a leather cover over an inflated rubber bladder. It weighs roughly from thirteen to fifteen ounces. Each team is composed of a goal-keeper, two backs, three half-backs, and five forwards. The maximum size of the ground is 130 by 100 yards; the minimum, 100 by 50 yards. The goals are 8 yards wide by 8 feet high. The usual length of time played is ninety minutes, the two teams changing ends at half-time to neutralize any advantage from wind, etc. The interval at half-time may not exceed five minutes except by consent of the referee. The team winning the toss has the option of kicking off or selecting the goal to defend during the first three-quarters of an hour.

The game is started by the centre forward of one side kicking the ball, which is placed in the centre of a circle of ten yards radius in the middle of the ground, no member of the opposing side being allowed within the circle at the time. The goal-keeper on each side is the only man allowed to touch the ball with his hands, and then only in his half of the ground. He must not carry the ball more than two steps, or his side will have a free kick given against it. The ball can be passed from one player to another in any direction, but a player who is off-side is out of play, and cannot touch the ball or impede an opponent without incurring the penalty of a free kick until it has been played by one of his opponents. A player is off-side if he touches the ball when it is passed to him by one of his own team from behind him, unless there are at least three of his opponents nearer to their own goal-line than he is at the moment when the ball is kicked to him. Under no circumstances can a player be off-side if he receives the ball after it has been last touched by an opponent, nor can he be off-side in the case of a kick from goal or a corner kick, or if he be behind the ball when it was last played by an opponent or a member of his own side.

If a player is given off-side by the referee, his opponents are allowed a free kick, no one being allowed within ten yards of the kicker except the members of his own team. Free kicks are also given against a player who intentionally handles the ball, who kicks, trips, jumps at, shoves, or holds an opponent, who charges him from behind (unless the opponent is impeding a player), and who plays in a



British Association Football

A FORWARD PASS—THE BALL IS IN MID-AIR

A POWER PLAY THROUGH THE LINE

Photos Courtesy Northwestern Univer[illegible]

THE BALL CARRIER BEING TACKLED FROM BEHIND

manner likely to cause injury. A penalty kick is awarded against a player who, when within the penalty area (eighteen yards out, by forty-four yards across from his own goal-line), intentionally, trips, charges from behind, shoves, kicks, jumps at, or holds an opponent. When a penalty kick is awarded, all players except the one taking the penalty kick and the opposing goal-keeper (who must not advance from his goal-line) stand outside the penalty area, and the ball must be kicked from a fixed point opposite to the centre of the goal and twelve yards from the goal-line. A goal may be scored from a penalty kick, and from a free kick when awarded for an infringement of Law 9 (which includes tripping, kicking, and intentional handling of the ball), but not from other place kicks.

If a player kicks the ball over the touch-lines at the sides of the ground, it is said to be in touch, and a member of the opposing team throws it in. The thrower must face the field of play, and must throw the ball from over his head with both hands, keeping parts of both feet on the line. A goal cannot be scored from a throw-in direct. If a player plays the ball over his opponent's goal-line, the latter have a goal kick—*i.e.* a free kick is taken from within that half of the goal area which is nearest the point where the ball went over. If a player plays the ball over his own goal-line, the opposing side take a corner kick—*i.e.* a free kick is taken from a point within one yard of the corner of the ground nearest the point where the ball went over. A goal cannot be scored from a corner kick direct. A referee with a whistle acts as timekeeper and judge of the game. He sees that the rules are observed and enforces all penalties, and his decisions are final.

Rugby Union Football, called "Rugger," for short, is played on a field not exceeding 110 yards in length and 75 yards in breadth. The ball is oval in shape, and consists of a leather cover over an inflated rubber bladder. Its length is from 11 to 11¼ in.; length circumference, 30 to 31 in.; width circumference, 25 to 26 in.; and weight, 13½ to 14½ oz. The object of each team is to score a number of points by getting tries and goals. A try equals three points, and is made by carrying or kicking the ball into the opponent's in-goal (see diagram), where it must be placed on, or touched while lying on, the ground. A goal is scored by kicking the ball over the cross-bar and between the uprights of the opponent's goal. There are four kinds of goal—*viz.* (1) A goal from a try (a placed goal), which equals five points (three for the try, and two for the goal). When a team has gained a try, one of its players brings the ball into the field of play in a line parallel to the touch-lines. He places it on the ground at any distance from the goal-line, and the kick at goal is taken by another player. The opposing side must not cross its goal-line into the field of play until the ball has been placed on the ground for the kick. (2) A goal from a drop kick (a dropped goal), which equals four points. (3) A goal from a free kick which has been awarded for a fair catch, or, as it is generally known, a mark. This equals three points. If a player catches the ball direct after it has been kicked, knocked on, or thrown forward by an opponent, he can claim a fair catch by instantly making a mark with his heel where he caught the ball. The opposing team cannot advance beyond this mark, and a free kick can be taken from any spot behind the mark, in a line parallel to the touch-line. (4) A penalty goal, which counts as three points, and can be scored from a free kick which has been imposed on the opposing team as a penalty for some offence.

Each team consists of one full-back, four (sometimes three) three-quarter backs, two half-backs, and eight forwards. The team winning the toss has choice of in-goal or kick-off. The time played is seventy or eighty minutes, and the teams must change ends at half-time. The game is started by the kick-off being made from the half-way line, the teams lining up across the ground facing each other. This is also the procedure adopted after a goal has been scored and after half-time. Once the game is started, any player who is on-side may kick or pick up (with three exceptions) and run with the ball. He may pass or knock it to another player, provided he does not pass, throw, or knock it forward. If while holding or running with the ball he is tackled by an opponent, and the ball is fairly held by that opponent with two hands, he must at once put it on the ground. The ball must then either be kicked on, or a scrummage must be formed by the opposing forwards massing in two bodies, putting their heads down and shoving at each other, with the ball on the ground between their feet. The three cases mentioned above in which the ball must not be picked up are, when it is in a scrummage, when it has been put down after it has been fairly held, and when it is on the ground after a player has been tackled.

A player is off-side if he enters a scrummage from his opponent's side, or if the ball has been kicked, touched, or is being run with by one of his own side behind him. He must not interfere with the game in any way until he is on-side again, which happens when an opponent has run five yards with the ball, or when it has been kicked by or has touched an opponent, or when one of his own side has run in front of him, either with the ball or after having kicked it while behind him. A free kick (unless the offence is unintentional) or a scrummage, at the option of the opposite side, is the punishment for a breach of the off-side rule. Off-side is the most commonly committed offence in the game; next come passing and knocking the ball forward. Unless a player does these wilfully and systematically (in which case the penalty is a free kick), a scrummage is at once formed where the offence occurred. There are many other less common offences which are punished by a free kick being awarded to the opponents of the offender. The chief are: intentionally handling the ball in or picking it out of the scrummage; not putting the ball down at once when tackled and held; wilfully hacking, or tripping, or impeding an opponent; not getting up immediately when on the ground; tackling an opponent who has not got the ball.

When the ball is kicked over the touch-line, it belongs to the side opposite to that which last touched it; but if it is carried over, it belongs to the side which took it over. A player of the side to which the ball belongs can then bring it into play either by scrummaging it at any spot at right angles to the touch-line, ten yards from the place which it went into touch, or he can throw it out at right angles to the touch-line for one of his side to catch. The ball is dead when it or the player carrying it crosses the dead-ball line, or in touch-in-goal, after a player has touched it down behind his own goal, and after a try has resulted in an ineffectual place-kick at goal. The defending side then drop-kicks or punts the ball from its 25 line.

A referee acts as timekeeper and sole judge of the game, two touch judges assisting him by holding up a flag when and where the ball goes into touch, and also helping him in judging a goal and in other ways.

Consult Spalding's *Official Football Guide* (annual); Jeffery's *Football: Association and Rugby;* Gibson and Pickford's *Association Football and the Men Who Made It;* Davis' *Football, the American Intercollegiate Game* (1911); Reed's *Football for Public and Player* (1913); Raphael's *Modern Rugby*

Football (1919); Roper's *Winning Football* (1920); Camp's *Football Facts and Figures*, and *Football Without a Coach* (1920); Weyand's *American Football*.

Foote, ANDREW HULL (1806–63), American naval officer, son of Samuel A. Foote (q.v.), was born in New Haven. He studied at West Point and in 1822 became a midshipman in the U. S. navy. In 1830 he became a lieutenant; in 1841–3 was a teacher of midshipmen at the U. S. Naval Hospital in Philadelphia; and in 1849–51, as commander of the brig *Perry*, was engaged in African waters in the suppression of the slave trade, subsequently writing a book entitled *Africa and the American Flag* (1854). While commanding the *Portsmouth* on the East India Station he captured the 'Barrier Forts' in the Canton river, China (November, 1856). He commanded the Brooklyn Navy Yard (1858–61), and late in 1861, during the Civil War, he was placed in command of the fleet of gunboats in western waters. He supervised the building of a large part of this fleet; on Feb. 6, 1862, captured Fort Henry unaided, and on Feb. 14 unsuccessfully attacked Fort Donelson (where he was wounded). The fort, however, soon afterward surrendered to the land forces under Grant. (See DONELSON, FORT.) In co-operation with General Pope, Foote captured Island No. 10 (April 7, 1862), but in July was forced by his wound to relinquish command of the western flotilla. In the same month he had been promoted to the rank of rear-admiral. After a brief service as chief of the Bureau of Equipment and Recruiting, he was ordered to Charleston, to supersede Admiral Dupont, but died at New York before he could assume command. Consult *Life* by Hoppin.

Foote, ARTHUR W. (1853–1937), American musician and composer, was born in Salem, Mass. He was graduated in 1874 from Harvard, where he studied music under John K. Paine, and in 1875 took the degree of A.M. in music. He studied piano and organ with B. J. Lang, in Boston, and from 1878 to 1910 was organist of the First (Unitarian) Church in Boston. His compositions include pieces for chorus with and without accompaniment for orchestra or piano, songs for one voice and part songs, piano and organ pieces, chamber music, suites, overtures, etc. He is the author of *Modulation and Related Harmonic Questions*, and, with W. R. Spalding, *Modern Harmony*. He was a member of the National Institute of Arts and Letters and fellow of the American Academy of Arts and Sciences.

Foote, HENRY STUART (1800–1880), American public official, was born in Fauquier county, Va. He was graduated from Washington College, Lexington, Va. (1819), and after beginning a law practice at Jackson, Miss., in 1826, took an active part in politics, associating himself for a time with the extreme State rights, secession wing of the Democratic party. In 1847 he was elected to the U. S. Senate, was an active supporter of Clay's compromise measures of 1850, and had a personal encounter with Senator Thomas H. Benton of Missouri on the floor of the Senate. John A. Quitman being the secessionist candidate for governor of Mississippi in 1852, Foote resigned from the Senate to become the Unionist candidate and defeated Jefferson Davis, in whose favor Quitman had withdrawn. From 1854 to 1858 he lived in California, returning to reside in Vicksburg, Miss. He was active in opposing secession at the Southern Convention which met in Knoxville, Tenn., May, 1859. Subsequently removing to Nashville, he first vigorously opposed, but finally acquiesced in, the secession of Tennessee and represented it in the Confederate Congress. He distinguished himself there by his bitter antagonism to his old rival, Jefferson Davis, favoring a discontinuance of the war because of his alleged incompetency, and advising the acceptance of Lincoln's peace terms. He was influential in shaping the reconstruction policy, and supported Grant's administration. That President appointed him director of the U. S. Mint at New Orleans, which office he retained until a few months previous to his death. His chief publications are: *Texas and the Texans* (1841); *The War of the Rebellion; or Scylla and Charybdis* (1867); *Personal Reminiscences*.

Foote, MARY HALLOCK (1847), American author, was born (Hallock) in Milton, N. Y., was married (1876) to Arthur D. Foote, a civil engineer, and afterward lived in the mining districts of Colorado, Idaho, and California. She attained proficiency as an illustrator, and in her fiction and drawings gave faithful pictures of western and Mexican life. Her books include *The Led Horse Claim* (1883), *The Last Assembly Ball* (1889); *Cœur d'Alène* (1894); *In Exile, and Other Stories* (1894); *The Cup of Trembling and Other Stories* (1895); *The Prodigal* (1900); *The Desert and the Sown* (1902); *A Touch of Sun, and Other Stories* (1903); *The Royal Americans* (1910); *A Picked Company* (1912); *The Valley Road* (1915); *Edith Bonham* (1917); *The Ground Swell* (1919).

Foote, SAMUEL (1720–77), English actor and dramatist, was born in Truro, Cornwall. He entered the Temple, but turned to the stage, and in 1747 opened the Haymarket Theatre with his *Diversions of the Morning*. In this and other pieces he introduced well-known living characters, and by his powers of mimicry drew large audiences. The theatre was closed by order of the magistrates, but Foote hit on the device of inviting his friends to 'a cup of tea,' for which tickets were to be obtained at the coffee-houses. He appeared in a great number of parts in London, Edinburgh, and Dublin. In 1766 he broke his leg—the result of a practical joke—while hunting with the Duke of York, who subsequently procured for him a royal patent for a theatre in Westminster (1766). Foote then purchased and renewed the Haymarket. While on the way to France, he died at Dover. Among his chief works are *Diversions of the Morning* (1747–58); *The Minor* (1760); *The Liar* (1762); *The Tryal of Samuel Foote* (1763); *The Mayor of Garratt* (1764); *The Bankrupt* (1776); *The Capuchin* (1776). Consult Bosweli's *Johnson;* Cooke's *Memoirs*, and Fitzgerald's *Samuel Foote*.

Foote, SAMUEL AUGUSTUS (1780–1846), American politician, was born in Cheshire, Conn. He was graduated from Yale College in 1797, became a merchant in New Haven, and served several years in the Connecticut legislature. He was a Whig member of Congress 1819–21, 1823–5, and 1833–4, resigning to serve as governor of Connecticut (1834–6). From 1827 to 1833 he was a member of the U. S. Senate, and in 1829 introduced the 'public land' resolution which brought on the famous debate between Webster and Hayne (see FOOTE'S RESOLUTION).

Foote's Resolution, a resolution introduced in the U. S. Senate by Samuel A. Foote, of Conn., on Dec. 29, 1829, instructing the Committee on Public Lands 'to inquire into the expediency of limiting for a certain period the sales of the public lands to such lands only as have heretofore been offered for sale, and are subject to entry at the minimum price; and, also, whether the office of Surveyor General and Surveyors may be abolished without detriment to the public interest.' The resolution itself was of relatively minor importance, but it was

regarded as evidence of the jealousy and hostility of the East to the West; and the South, smarting under the tariff of 1828, the passage of which was charged in large part to New England's sectional selfishness, supported the West. The debate over the resolution (which was finally laid on the table, May 21, 1830) had little directly to do with it, and was marked particularly by the famous contest between Webster and Hayne (see HAYNE, R. Y.; WEBSTER, DANIEL).

Foot-pound, the work done in lifting a pound through a foot at the earth's surface. The force overcome is the weight of the pound, or the attraction between it and the earth; and as this attraction varies slightly from point to point no the earth's surface, it follows that the value of the footpound is not exactly the same at different places. It is slightly less at the equator than in higher latitudes. The corresponding unit of work in the metric system is the kilogrammetre, which contains 7,233 footpounds. See also HORSE-POWER.

Foot-rot, a hoof disease affecting sheep, characterized by lesions on the heel or at the back or front of the cleft of the foot. An inflammation rapidly penetrates under the horny tissue, while from the ulcerous opening there exudes a thin purulent discharge with a pungent and characteristic odor. The disease is due to bacterial invasion of abrasions of the skin or other tissues.

Control of foot-rot is effected by separation of the sick from the healthy animals and disinfection of pens and sheds. Treatment is by local antiseptics and removal of all scabs and shreds of diseased tissue, after which an emollient dressing of sublimed sulphur and mutton tallow, lard, or vaseline should be applied.

Footscray, town, Victoria, Australia, on the Salt Water River, 3 miles west of Melbourne, of which it is a suburb. It has large bluestone quarries from which much of Melbourne has been built. Pop. 23,643.

Foot-washing, a religious ceremoney practised in different branches of the Church at various times. In the East the use of sandals made necessary the frequent washing of the feet, and it was considered an act of hospitality to perform this service for others. Jesus, at the Last Supper, washed the feet of his disciples, and the Christians of the early post-apostolic age considered the example as mandatory. The ceremony is still solemnly performed on certain occasions by the Pope, the king of Spain, a number of bishops and monastic superiors, and by several minor Baptist bodies.

Foppa, VINCENZO (*c.* 1427-1515), Italian artist, founder of the Lombard school, was born in Brescia. Little is known of his early years, but about 1456 he went to Milan, where he adorned the Medici Palace, the hospital, and the Palazzo dell' Arengo with mural paintings, those in the palace portraying scenes from the life of Trajan. In 1461 he returned to Brescia, where he painted in the Church of the Carmine. Between 1480 and 1489 he was engaged in executing an altar-piece for the Bishop of Savona which is now to be seen at the Church of Santa Maria di Castello in Savona. His frescoes in the Carmine, though much faded, are still visible. They include the *Evangelists;* the *Four Doctors of the Church;* and a *Crucifixion.* Other works are *St. Jerome Penitent before a Cross; Adoration of the Magi; St. Sebastian; Virgin and Child with two Kneeling Prophets.* Consult Ffoulkes and Maiocchi's *Vincenzo Foppa of Brescia.*

Forage, for'ej, in general, any food suitable for horses or cattle (see FEEDING STUFFS); in military usage in the United States army the food allowance for animals owned by the Government, or owned and kept by mounted officers for their official use. The authorized allowance for a horse is 14 pounds of hay, and 12 pounds of oats, corn, or barley; for a mule 14 pounds of hay, and 9 pounds of oats, corn, or barley.

Foraker, fôr'*a*-ker, JOSEPH BENSON (1846–1917), American politician, was born in Highland county, Ohio. At the age of sixteen he enlisted as a private in an Ohio regiment and served until the close of the Civil War. He was brevetted captain for efficient services in North Carolina and Georgia, and was appointed aid-de-camp to Gen. H. W. Slocum. He was subsequently graduated from Cornell (1869), began to practice law at Cincinnati, and from 1879 to 1882 was judge of the superior court in that city. He was defeated as the Republican candidate for governor of Ohio in 1883, was elected in 1885 and 1887, and defeated in 1889. He was elected to the U. S. Senate in 1896 and re-elected in 1902. He was a delegate from Ohio to all Republican national conventions from 1884 to 1900, and chairman of the delegation in 1884 and 1888. In 1896 and 1900 he nominated McKinley as the party candidate for the presidency, and vigorously sustained the Spanish War policy. In his extensive law practice he became well known as a corporation attorney, and in the Senate proved an active opponent of radical legislation on railroad traffic and other anti-corporation measures. He was a bitter critic of President Cleveland's proposal to restore the Confederate battle-flags to their regiments, and, on account of an expression used in one of those speeches, he became known as 'fire-alarm' Foraker. In 1909 the publication of the Archbold letters, showing that he had received retainers from the Standard Oil Company while in office, resulted in his withdrawal from politics.

Foraminifera, fō-ram-i-nif'-*er-a,* a class of unicellular animals or Protozoa, almost always marine in distribution, most characteristically provided with limy shells, which have formed the chalk of the past and are now forming similar deposits in the deep sea.

The shell, which is much better known than its tenant, is characteristically calcareous, chambered, and covered with minute holes. When partitions are formed between successive chambers, apertures are left through which bridges of protoplasm preserve the vital continuity.

The Foraminifera are mostly marine, and occur at all depths; a few are pelagic; most live on submerged objects or at the sea bottom. A few from brackish and even fresh water are known, and one species (*Gromia terricola*) has gone ashore. The pelagic forms, as they die, sink gently to the bottom, and are there forming, especially at depths between 1000 and 2000 fathoms, great beds of Globigerina ooze or modern chalk.

Forbach, for'bäK, town, Lorraine, 6 miles by rail southwest of Saarbrücken. It manufactures papier-maché and various other commodities. On Aug. 6, 1870, it was the scene of a German victory over the French. Pop. 10,107.

Forbes, fôrbz, ALEXANDER PENROSE (1817–75), Scotch Episcopal divine, was born in Edinburgh. After being in the East India Company's service (1837–9), he entered Oxford University, where he became a close friend of Dr. Pusey (q. v.), one of the leaders of the Oxford movement. He was ordained deacon and priest in 1844, became incumbent of Stonehaven, Kincardineshire, in 1846, and vicar of St. Saviour's, Leeds, in 1847. In 1848 he was consecrated bishop of Brechin. In 1860 he was censured for teaching the doctrine of the Real Presence. His chief works are: *Commentary on the Seven Penitential Psalms* (1847); *Commentary on the 'Te Deum'* (1850); *Short Explanation of the*

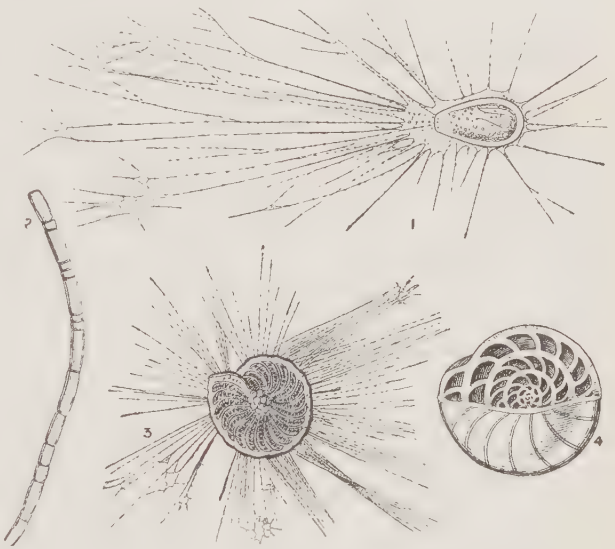
Nicene Creed (1852); *Commentary on the Canticles* (1853); *The Pious Life and Holy Death of Helen Inglis* (1854); *The Arbuthnot Missal* (edited with his brother, G. H. Forbes, 1864). He also translated into Greek *The Scotch Communion Office* (1865) and published *Kalendars of Scottish Saints* (1872).

Forbes, ARCHIBALD (1838–1900), British journalist, was born in Morayshire, Scotland. He became correspondent for the *London Daily News*, was with the German army through the Franco-German War, and in 1872 published *My Experiences of the War between France and Germany*. He was in India during the famine of 1874, and passed through the civil wars in Spain. In 1875–6 he travelled with the Prince of Wales through India. Later his work took him through the Servian War (1876), when he narrowly escaped death at the hands of the Turks, and the Russo-Turkish War of 1877, to Cyprus and India in 1878, and Ulundi, South Africa, in 1880. Among his chief works are *Glimpses through the Cannon Smoke* (1880); *Life of Chinese Gordon* (1884); *Souvenirs of Some Continents* (1885); *Life of the Emperor William of Germany* (1888); *The Afghan Wars* (1892); *Czar and Sultan* (1894); *Camps, Quarters, and Casual Places* (1896); *Life of Napoleon III.* (1898). He also wrote an account of *The Black Watch* (1896) and contributed to *Battles of the Nineteenth Century* (1902).

Forbes, DUNCAN (1685–1747), Scottish judge and patriot, second son of Duncan Forbes of Culloden, was born near Inverness, studied law in Edinburgh and Leyden and became sheriff of Midlothian. In 1715 he distinguished himself by his loyal support of the government, in 1722 became a member of Parliament for Inverness, in 1725 was appointed Lord Advocate, and in 1737 became president of the Court of Session. In the uprising of 1745, he did valuable work for the cause of England, at the same time showing great humanity to the rebels, and opposing the cruel policy of the Duke of Cumberland. He is the author of several theological works, which include *Letter to a Bishop Concerning some Important Discoveries in Religion and Theology* (1732), wherein he expounded Hutchinson's *Moses' Principia; Some Thoughts Concerning Religion, Natural and Revealed* (1735); *Reflections on the Sources of Incredulity* (1750).

Forbes, EDWARD (1815–54), British naturalist, was born in Douglas, Isle of Man. In 1841–2 he was naturalist to H.M.S. *Beacon*, for investigating the botany and geology of the Mediterranean and in 1843 wrote a *Report on the Mollusca and Radiata of the Ægean Sea* (1843). He was appointed successively to the chair of botany at King's College (1842), palæontologist to the Geological Survey (1844), professor of natural history in the Royal School of Mines (1851), president of the Geological Society of London (1853), and professor of natural history in Edinburgh University (1854). Among his most notable works are *On the Distribution of Pulmoniferous Mollusca in Europe* (1838); *Land and Fresh Water Mollusca of Algiers* (1839); *History of British Star Fishes* (1842); *History of British Mollusca*, with J. Hanley (4 vols. 1848–52).

having a natural inclination towards the study of physics, he devoted himself to science and at the age of nineteen was made a member of the Royal Society of Edinburgh. In 1831 he co-operated with Sir David Brewster in founding the British Association, and in 1833 was chosen professor of natural philosophy in Edinburgh University. In 1859 he became principal of St. Andrews. For his discovery of the polarization of heat he was awarded the Rumford medal. His principal works are *Travels through the Alps of Savoy and Other Parts of the Pennine Chain, with Observations on the Phenomena of Glaciers* (1843), from both the scientific and literary standpoint, a standard work; *Tour of*



Types of Foraminifera

1. Gromia oviformis. 2. Bathysiphon filiformis. 3. Polystomella strigillata. 4. Nummulites Cummingii.

Forbes, EDWIN (1839–95), American artist, was born in New York City, and studied under A. F. Tait. He performed notable work during the Civil War, with the army of the Potomac, in securing a series of sketches of incidents of the struggle. Of these he made a permanent record in etchings, the first proofs of which were bought by General Sherman for the U. S. Government. Included are *Sanctuary*, *Coming through the Lines*, *The Reliable Contraband*, and *The Reveille*. After 1878 he was occupied chiefly with landscape and cattle painting.

Forbes, JAMES DAVID (1809–68), Scottish scientist, the youngest son of Sir William Forbes (q.v.), was born in Edinburgh. He was destined for the bar but

Mont Blanc and Monte Rosa (1855); *Occasional Papers on the Theory of Glaciers* (1859).

Forbes, JOHN (1710–59), Scottish-American soldier, was born in Fifeshire, Scotland. After abandoning the practice of medicine for service in the British army, he went to America as brigadier-general in 1757, and took part in the expedition against Louisburg early in 1758. In the autumn he led the expedition of 7,000 men, including 2,000 Virginians under Washington, against Fort Duquesne, reaching the fort just after it had been blown up and abandoned by the French. He renamed it Fort Pitt, after the English statesman who planned the campaign. After concluding treaties with the Indians, he returned, and died in Philadelphia soon afterward.

His persistence won him the name of 'Iron Head.'

Forbes, SIR JOHN (1787–1861), Scottish physician, was born in Cuttlebræ, Banffshire. He practised in Penzance and Chichester and in 1840 went to London, where he became physician-in-ordinary to Queen Victoria and the Prince Consort. He was knighted in 1853. He was chief founder of the *British and Foreign Medical Review* (1836–47), and wrote *A Manual of Select Medical Bibliography* (1835), *Illustrations of Modern Mesmerism* (1845), and *Treatise on Diseases of the Chest* (1849). He was an editor of a *Cyclopædia of Practical Medicine* (1832–5).

Forbes, STANHOPE ALEXANDER (1857–), English painter, was born in Dublin, of English and French parents. He studied in the Royal Academy schools and in Paris under Bonnat, and exhibited in the Academy regularly from 1882. He was elected A.R.A. in 1892; R.A. in 1910. Among his best pictures are *The Fish Sale; Forging the Anchor; The Smithy; Christmas Eve; The Health of the Bride; The Lighthouse;* and two panels in the Royal Exchange, London.

Forbes, STEPHEN ALFRED (1844–1930), American naturalist, was born in Silver Creek, Ill. He served in the Civil War, and in 1872–7 was curator of the Museum of Illinois, State Natural History Society. He taught zoology at the Illinois State Normal School (1875–8), was director of the Illinois State Laboratory of Natural History (1877–1917), and was dean of the College of Science (1888–1905) and professor of zoology (1884–1909), and entomology (1909–21), University of Illinois.

Forbes, W. CAMERON (1870–), American administrator, was born in Milton, Mass. He attended Milton Academy, was graduated from Harvard University (1892), entered upon a business career, and became officer and director in numerous corporations. Appointed secretary of commerce and police in the Philippine Islands in 1904, he supervised the constabulary, post-office, and many other public departments. He became vice-governor of the Philippines in 1908, and was governor from 1909 to 1913. He was a member of the Wood-Forbes Mission sent by President Harding to investigate conditions in the Philippines in 1921.

Forbes, SIR WILLIAM (1739–1806), Scottish banker and writer, was born in Edinburgh. He was apprenticed (1754) to an eminent banking firm in his native city and after six years obtained a small share as a partner. In 1773 he became the head of the firm of Forbes, Hunter and Company, one of the most reliable banking houses in Scotland. In 1781 he re-purchased his ancestral home of Pitsligo, forfeited in the rebellion of 1745, and did much to improve and beautify it. He published *Memoirs of a Banking House* (1803) and *An Account of the Life and Writings of James Beattie* (2 vols., 1806).

Forbes-Robertson, SIR JOHNSTON (1853–), English actor, was born in London. He was educated at Charterhouse and in Rouen; made his first appearance as Chastelard in *Marie Stuart,* in London, in 1874; and as a member of the stock company at the Prince's, Manchester, supported the tragedian, Samuel Phelps, whose pupil he became. One of his first successes was in 1879, as Sir Horace Welby in *Forget-me-not.* He played Romeo to Madame Modjeska's Juliet (1880), was seen as Claudio (1882), and as Launcelot and Buckingham with Irving at the Lyceum, and assisted at the farewell performance of Mr. and Mrs. Bancroft (1885). He first appeared in the United States in Miss Mary Anderson's company in 1884–5. In 1896 he became an actor-manager at the Lyceum, which he rented from Irving, producing *Romeo and Juliet,* Coppee's *For the Crown,* Sudermann's *Magda,* and *The School for Scandal.* He was long a member of Sir Squire Bancroft's, Sir John Hare's, and Sir Henry Irving's companies. His Macbeth (at the Lyceum, London, 1898) met with great success, and his Hamlet was a notable performance. Among his later productions were: *Men and Mice; The Light that Failed; The Conqueror; Mrs. Grundy; Cæsar and Cleopatra; The Passing of the Third Floor Back; The Sacrament of Judas.* He retired from the stage in 1916. Consult his *A Player under Three Reigns* (1924).

Forbidden Fruit, or ADAM'S APPLE, a name given to various species of the genus Citrus. In England it is usually applied to the fruit of the shaddock (q.v.). In France *C. aurantium,* more like an orange, is known as forbidden fruit.

Force, in dynamics, is a concept originating in our muscular sense. By Newton it is defined as that which causes change of 'motion' in a body, where the word motion involves the amount of matter in the body and its velocity. This we now call the momentum = (mass × velocity); and we measure force by the rate of change of this quantity. Fundamentally it is illogical to define force in terms of mass and acceleration; for we measure mass, or compare masses, by an appeal to forces. But experience tells us that what we call mass is associated with a permanent property of the body—its property, namely, of inertia; and practically we come to regard mass as a constant invariable quality. Measuring it by an appeal to the force of gravitation, we define any other force in terms of it.

Practically in the United States the unit of force is the pound weight; but as this force acting on a pound causes an acceleration of 32.2 ft. per second, it is not the absolute unit of force if we assume the pound to be the unit of mass. For the unit force acting on unit mass produces unit acceleration. By defining the unit mass to be g pounds, or by defining the unit force to be $\frac{1}{g}$ pound weight, we get a consistent system of absolute units. The engineer uses the former system by adhering to the pound weight as the unit force; the physicist prefers the latter system.

In the centimeter-gram-second system of units, the unit force is called the dyne, and is the force which, acting on one gram for one second, will generate a velocity of one centimeter a second. See DYNAMICS; KINETICS.

Force, MANNING FERGUSON (1824–99), American soldier and writer, son of Peter Force, was born in Washington, D. C. He was graduated from Harvard and the Harvard Law School, and served throughout the Civil War, attaining the rank of brigadier-general (1863) and brevet major-general of volunteers (1865) for especial gallantry in the assault on the Confederate works at Atlanta. He was judge of the Court of Common Pleas of Hamilton county, Ohio, in 1867-77, and judge of the Superior Court of Cincinnati in 1877–87. He wrote *From Fort Henry to Corinth* (1881), *Marching Across Carolina* (1883), *Personal Recollections of the Vicksburg Campaign* (1885), and edited Walker's *Introduction to American Law* (1878) and Harris' *Principles of Criminal Law* (1880).

Force, PETER (1790–1868), American editor and antiquarian, was born in Passaic Falls, N. J. He was the editor of the *National Journal* (1823–30) and of the *National Calendar,* a statistical annual, at Washington, D. C. (1820–36), and was mayor of Washington (1836–40), but is best known as the compiler of the *American Archives, A Collection of Authentic Papers . . . forming A Documentary History of the North American Colonies* (9 vols. 1837–53), which was really only a small part of a projected vast collection of documents. Six volumes relate to the years 1765–76, and the remaining three to

1776; and though the work is incomplete, it is invaluable to the student of the early Revolutionary period. Force's valuable collection of books and pamphlets was bought by the U. S. Government in 1867, and is now in the Congressional Library.

Force Bill, a name popularly applied to several bills passed by the United States Congress. The first, which became a law on Mar. 2, 1833, during the Nullification excitement in South Carolina, was passed for the purpose of enforcing the revenue laws of the United States. (See NULLIFICATION.) The name is also applied to the act of May 31, 1870, to enforce the Fifteenth Amendment; to the act of Feb. 28, 1871, supplementary thereto; to the act of April 20, 1871, for the enforcement of the Fourteenth Amendment; and to the Lodge Election Bill in 1890 providing for the appointment, on petition, of Federal officials on local election boards, which failed of passage.

For'ceps, a term used to designate a two-bladed instrument of joined metal with which objects are grasped. The principal application of forceps is in surgery and dentistry. (See SURGERY, *Surgical Instruments.*)

Small forceps are in constant use by watchmakers and jewellers for placing minute portions of their work in position, and an instrument of the same class is invaluable to the chemist and mineralogist for adjusting weights and working with the blowpipe.

Forcible Entry and Detainer, the offence of unlawfully entering upon or retaining possession of real property by means of force or threats of violence. Under the common law one rightfully entitled to the possession of land was permitted to retake it from a person who unlawfully occupied it, using whatever force he might find necessary. Under the statutes of practically all the States of the United States forcible entry upon land by one out of possession is prohibited as a breach of the peace, and is a criminal offence, the plea of ownership being no justification for the use of force.

Forcing, in gardening, a term used to designate a process in which artificial heat is applied so that flowers, fruits, or other products of plants are obtained at a date or season other than that at which they may be had in the ordinary course of culture. Of forced vegetables the most important in the United States are lettuce, tomatoes, cucumbers, radishes, muskmelons, rhubarb, and asparagus; of fruits, the grape and strawberry.

Among flowers, roses, lilies of the valley, azaleas, violets, mignonette, and sweet peas are those most commonly forced, together with such bulbs as hyacinths, tulips, and narcissi. See HOTBED; HOTHOUSE.

Ford, EDWARD ONSLOW (1852–1901), English sculptor, was born in London. He began to paint in Dunkirk, and later in the Antwerp Academy schools. In 1875 he exhibited a bust of his wife at the Royal Academy, of which he was elected associate in 1888, and full member in 1895. His first important statue was of Sir Rowland Hill (Royal Exchange). Among his many other portrait-busts and statues are *Gladstone* (City Liberal Club, London), *Gordon on a Camel* (Chatham and Khartum), the *Jowett Memorial* (Oxford), *Queen Victoria* (Manchester), and equestrian statues of Lord Strathnairn (Knightsbridge) and the Maharajah of Mysore. Of his statuettes, *Folly, The Singer, Dancing,* and *Music* are in the Tate Gallery, London.

Ford, SIR FRANCIS CLARE (1828–99), English diplomatist, son of Richard Ford (q.v.). After a short period in the army he resigned and entered the diplomatic service. He was secretary of legation and acting *chargé d'affaires* (1867–8) at Washington; secretary in the diplomatic service at St. Petersburg (1871) and Vienna (1872); British agent at Halifax (1877), before the International Commission regarding the U. S. fisheries treaty of 1871; minister to the Argentine Republic (1878), Brazil (1879), and Greece (1881); and ambassador at Madrid (1887), Constantinople (1892), and Rome (1893–8).

Ford, HENRY (1863–), American manufacturer, was born in Greenfield, Mich. He was educated in the district schools and very early showed great interest in mechanics. At the age of 16 he went to Detroit where he was trained as a machinist. In 1887 he became chief engineer of the Edison Illuminating Company, a position he held until 1899, meanwhile experimenting with the building of gasoline motor cars. In 1899 he became chief engineer of the Detroit Automobile Company and in 1903 he organized and became President of the Ford Motor Company, Detroit, now the largest automobile manufactory in the world, employing over 200,000 men. The company has been built up by turning back profits into construction, it has never issued bonds nor borrowed money and is owned entirely by Henry Ford and his son Edsel. In January, 1914, Ford announced the adoption of a unique profit sharing plan involving the distribution among his employees of half the estimated net annual profits to be added to the usual wage in the form of a bonus—thus establishing a minimum wage of $5.00 a day. In 1926 the minimum wage was $6.00 a day. Before the United States entered the Great War (1914–18) Ford was active on the Neutral Conference for Continuous Mediation, and as head of the Ford Peace Party he sailed for Europe on the *Oscar II.* (Dec., 1915) with the object of bringing about peace by Christmas. When the United States became a belligerent, however, Ford placed himself at the disposal of the Government, turned over his Detroit plant for the manufacture of war material and built another plant for the production of submarine chasers. He was made a member of the Shipping Board in November, 1917. In 1918 he received the Democratic nomination for U. S. Senator from Michigan but was defeated by a small margin. He has founded a trade school for the education of boys and the Henry Ford Hospital in Detroit. In 1918 President Wilson appointed Ford to the Wage Umpire Board. In 1940 The Ford Motor Company undertook to meet the demands of national defense measures and equipped its factories for the manufacture of airplanes. Mr. Ford is the author of three books: *My Life and Work* (1925), *Today and Tomorrow* (1926), and *Moving Forward* (1931).

Ford, HENRY JONES (1851–1925), American journalist and educator, was born in Baltimore. He was graduated from Baltimore City College and was successively city editor of the Baltimore *Sun;* managing editor of the Baltimore *American* (1875–9); staff member of the New York *Sun* (1879–83), and of the Baltimore *Sun* (1883–5); managing editor of the Pittsburgh *Commercial Gazette* (1885–95) and the Pittsburgh *Chronicle Telegraph* (1895–1901); and editor of the Pittsburgh *Gazette* (1901–05). He became lecturer on political science at Johns Hopkins University in 1906, and professor of politics at Princeton in 1908.

Ford, JOHN (1586–*c.*1639), English dramatist, was born in Ilsington, Devonshire. He studied for the law and in 1602 became a bencher of the Middle Temple. His fame rests on his plays, which show a keen insight into the workings of the human heart, and reveal him as a better psychologist than a literary artist. His first dramatic work probably was *The Fairy Knight* and *The Bristowe Merchant,* written with Dekker, and *A Late Murther of the Sonn upon the Mother,* with Webster (1624). His best works are *'Tis Pity*

She's a Whore (1633), the theme of which is incest, and *The Broken Heart* (1633). Other works are *The Lover's Melancholy* (1629); *Love's Sacrifice* (1633); *Perkin Warbeck* (1634); *The Fancies Chaste and Noble* (1638); *The Lady's Trial* (1638); *Beauty in a Trance*, entered on the Stationers' Books (1653), but destroyed; *The Sun's Darling* in collaboration with Dekker (1656); *The Witch of Edmonton*, with Rowley and Dekker (1658).

Ford, JOHN THOMSON (1829–94), American theatrical manager, was born in Baltimore, Md., and early entered the minstrel business. He was manager of theatres in Richmond and Baltimore previous to his engaging in the same occupation in Washington, D. C. There he built three theatres, in one of which—the well-known 'Ford's Theatre'—President Lincoln was assassinated. Ford was arrested on suspicion of complicity but was soon cleared.

Ford, PAUL LEICESTER (1865–1902), American historical writer and novelist, was born in Brooklyn, N. Y. He was educated privately and travelled widely. His historical and bibliographical work includes the *Webster Genealogy* and a *Bibliography and Reference List of the History and Literature Relating to the Adoption of the Constitution.* He edited the *Writings of Thomas Jefferson*, in 10 volumes (1892) and wrote *The True George Washington* (1896), *The Many-Sided Franklin* (1899), *The Honorable Peter Stirling* (1894); *The Great K. & A. Train Robbery* (1897); *The Story of an Untold Love* (1897); *Tattle Tales of Cupid* (1898); *Janice Meredith* (1899); *Wanted: A Matchmaker* (1901); *Wanted: A Chaperon* (1902). He was the founder and editor of the *Bibliographer.* A dispute with his brother Malcolm concerning the inheritance of their father's estate resulted in his being shot by Malcolm, who then killed himself. He was a member of the National Institute of Arts and Letters.

Ford, WORTHINGTON CHAUNCEY (1858–), American author and editor, was born in Brooklyn, N. Y. He was chief of the Bureau of Statistics, Department of State, Washington, D. C. (1885–9); chief of the Bureau of Statistics, Treasury Department (1893–8); connected with the Boston Public Library (1897–1902); and chief of the division of manuscripts in the Congressional Library (1902–08). In 1908 he became editor of the publications of the Massachusetts Historical Society, and in 1929 was appointed director of the European Mission of the Library of Congress. A member of the American Academy of Arts and Sciences, of the American Philosophical Society, and of the National Institute of Arts and Letters, he published *The American Citizen's Manual*(1883) *The Standard Silver Dollar*(1884); *George Washington* (1899); *Boston Book Market, 1679–1700* (1917). He also edited *The Writings of George Washington* (1889–91).

Ford City, borough, Pennsylvania, in Armstrong County, on the Pennsylvania Railroad; 35 miles northeast of Pittsburgh. The leading manufactures are plate glass, pottery, house plaster and steel. Pop. (1910) 4,850; (1920) 5,605.

Ford'ham University, formerly Saint John's College, a Roman Catholic institution founded by Archbishop Hughes at the old Rose Hill Farm, Fordham, New York, and opened June 24 (St. John the Baptist Day), 1841. The College was administered by the diocesan clergy of New York until 1846, when it was purchased by the Fathers of the Society of Jesus. In the same year the New York Legislature granted it the right to give degrees in theology, arts, law, and medicine. In 1905 the Schools of Law and Medicine were opened, in 1911 a College of Pharmacy was organized, and in 1916 the Graduate School, Teachers' College, and the School of Social Service were established. The Medical School was discontinued in 1921, and the School of Business Administration was established that same year. In 1907, by amendment of the college charter, the name was changed to Fordham University, the name of Saint John's College, however, being retained by the collegiate department. For recent statistics see Table under the heading COLLEGE.

Fordun', JOHN OF (d. *c.* 1385), Scottish chronicler, was a secular priest, and probably a chaplain of the cathedral church of Aberdeen. He is said to have travelled on foot through Britain and Ireland in search of materials for his *Scotichronicon*, which comprises five books and brings the history of Scotland down to the death of King David I. in 1153.

Fordyce, fôr'dis, town, Arkansas, in Dallas County, on the Chicago, Rock Island and Pacific, and the St. Louis Southwestern Railroads; 38 miles southwest of Pine Bluff. It is a rising trading centre for a cotton and lumber district. Pop. (1910) 2,794; (1920) 2,996.

Fore-and-aft Rig, one in which the sail, of generally rectangular shape and with spars at top and bottom, hangs parallel to the mast, as in schooners.

Foreclo'sure, the legal proceeding by which a lien is enforced. Foreclosure suits are conducted in courts exercising equitable jurisdiction, and are subject to the rules of equity. The debt which the lien protects must be due and unpaid, and all persons having an interest in the property subject to the lien must be made parties to the action. This is the only relief asked against such defendants, but against the principal debtor a deficiency judgment may be claimed. Mechanics' liens and other statutory liens are enforced by these equitable actions. See LIEN; MORTGAGE.

Forefathers' Day, the anniversary of the landing of the Pilgrims at Plymouth, Mass., on Dec. 11 (Dec. 21, new style), 1620.

Foreigner. See ALIEN.

Foreign Exchange. See EXCHANGE.

Foreign Law, from the point of view of the courts of one jurisdiction, signifies the law prevailing in any other jurisdiction. Thus the law of England is foreign to the courts of the United States, as likewise is the law of one State to the courts of another.

It is now the general rule, both in the United States and in England, that the judgment of a foreign court will be recognized and enforced, except where the court in question had no jurisdiction in the matter or was the victim of a fraud, or where the proceedings were tainted with corruption or gross irregularity. Article IV. of the United States Constitution provides that full faith and credit shall be given in each State to the public acts, records, and judicial proceedings of every other State, but this provision does not compel the courts of one State to enforce a judgment of the courts of another when the latter has no jurisdiction over the cause or the parties. See CONFLICT OF LAWS; JURISDICTION.

Foreign Legion (*Légion Etrangère*), a body of non-Frenchmen of all nationalities, recruited for the French service, organized at Toulon in 1831, and sent to assist in the conquest of Algeria.

In the Great War (1914–18), this organization performed many deeds of surpassing valor.

Foreign Missions. See MISSIONS.

Foreign Money. See MONEY.

Foreign Office, in Great Britain, that government department which carries on official intercourse with foreign states, controls the British diplomatic and consular services, and issues foreign office passports to naturalborn, and to naturalized British subjects. It has been a separate department since 1782. It has

been housed in its present buildings in Downing Street only since 1868. The continuity of foreign policy is maintained by a permanent staff, at the head of which are a permanent under-secretary and three assistant under-secretaries. The Secretary for Foreign Affairs is always a member of the Cabinet.

Foreign Trade. See TRADE; INTERNATIONAL TRADE: EXPORTS AND IMPORTS.

Foreign Wars of the United States, Military Order of, an American order composed of officers who served in the Revolutionary War, the War with Tripoli, the War of 1812, the Mexican War (1847), the War with Spain (1898), the China Relief Expedition (1900), the Nicaragua Campaign, the Vera Cruz Campaign, the Mexican Campaign (1916), and the World War with Germany (1917 and 1918); the lineal male descendants of such officers are also admitted to membership. The order was instituted in New York City Dec. 27, 1894, and was incorporated Jan. 15, 1895. Its objects are 'to honor and perpetuate the names of brave and loyal men; to keep in mind the memory of their martial deeds, and the victories which they helped to gain; to strengthen the ties of fellowship among the Companions of the Order; to foster the cultivation of Military and Naval Science; and to aid in maintaining National Honor, Union, and Independence.' There are commanderies in 15 States, in Canada and in France which number in its companionship a distinguished list of leading veterans and their descendants.

Foreland, fōr'land, NORTH and SOUTH, two chalk headlands on the east coast of Kent, 16 miles apart, with the Downs and Goodwin Sands (qq. v.) between. North Foreland lies about 1¼ miles north of Broadstairs, and has a lighthouse with light visible 20 miles. South Foreland, about 4 miles northeast of Dover, with cliffs 400 ft. high, forms the south boundary of St. Margaret's Bay. It has two lighthouses, visible respectively 23 and 26 miles.

Forensic Medicine. See MEDICAL JURISPRUDENCE.

Foreordination. See PREDESTINATION.

Foreshortening is the art of representing graphically upon a flat surface the relationship between different parts of the same object. By means of it the true appearance of objects of three dimensions can be suggested in drawings and pictures. In an absolute sense, foreshortening is a matter of drawing, and is attained by the correct placing and proportioning of the nearer to the more remote parts. Foreshortening is subject to the laws of perspective, and is in reality one of the severest and most searching tests of a draughtsman's skill. But while foreshortening is properly a question of draughtsmanship, it is in all pictorial representations not in pure outline supplemented and enhanced both in effect and truth by modelling, which represents the play of light on the surfaces and the difference of value caused by light and color.

Forester, Frank, pseudonym of Henry William Herbert (q. v.).

Foresters, Ancient Order of, a benevolent and fraternal organization claiming descent from a court of foresters established in 1745 at Knaresborough, England. A court was established at Leeds in 1790, when the title Ancient Royal Order of Foresters was adopted. The fraternity progressed rapidly until 1834, when the arbitrary attitude of the High Court forced a division, and 342 of the 358 courts then existing were reconstructed under the present title. The order was brought to America in 1832 by the formation of Court Good Speed in Philadelphia. The first court to survive was Court Brooklyn, founded in 1864.

Foresters, Independent Order of, a fraternal order, founded in 1874. It provides insurance benefits at a low cost, and maintains a sick benefit department, sanatoriums for the free treatment of members who contract tuberculosis, and an orphanage for the care and education of the orphans of deceased members.

Foresters of America, a fraternal and benevolent association established in 1864. Membership is open to white males of sound health and good character between 18 and 50 years of age. The order was under the jurisdiction of the High Court of England until 1889, when it was reorganized as an independent order.

Forest Fires. Ever since forests have existed, forest fires have in all probability occurred. Wood found in the Pleistocene formation shows the effect of fires, and charcoal in the peat bogs of the United States and Canada, some of which are estimated to be from 2,000 to 3,000 years old, indicates their occurrence in the remote past. Forest fires may be due to natural causes, of which lightning is the chief, approximately 10 per cent of all forest fires in the United States being of this origin; or to human agencies, in which case they may be traced in most cases to careless smokers, campers, brush burning, railroads, logging operations, or to incendiarism. Surface fires are those which spread over the surface of the forest floor and are fed by litter and undergrowth. These fires are fought by beating with sacks or green boughs, by throwing water or dirt on the flames, by trenching or by back-firing from a cleared fire line. Ground fires smoulder or burn only in the ground, consuming the humus and duff and often injuring the roots of trees. They are usually checked by surrounding them with a trench dug down to mineral soil. Crown fires are those which burn into the foliage of the trees, consuming the entire forest cover. They spread rapidly and are extremely difficult to control. Back-firing and the clearing of wide lines by machinery or hand labor are methods used to combat them. Portable pumps and hose are used when water is available.

Forest fires in the United States in recent years have caused an average annual loss of nearly a score of lives, and the destruction of timber and property worth at least $40,000,000, to which must be added also the huge intangible losses in damage to young trees, watershed and recreation values, the deterioration of the soil, and the unemployment and interruption of business resulting from fires. In the last twenty years there has been a notable arousing of public sentiment in regard to forest fire prevention and organized protection is being developed by Federal and state agencies. The National Forests have a highly organized and efficient system of fire protection and control, which includes the employment of patrols and lookouts, the maintenance of strategically located roads and trails and of telephone lines and emergency radio communication, and the careful preparation each season for rapid mobilization of fire-fighting forces. Modern science applied to the forecasting of fire danger and mechanized equipment developed in recent years are increasing the effectiveness of fire control. Airplanes are now used frequently for reconnoitering large fires and for transportation of equipment and supplies to inaccessible areas.

Revised by C. E. RANDALL, *U. S. Forest Service.*

Forest Law. The early Norman kings of England, in order to indulge their passion for hunting, declared the greater part of the unenclosed woodland of the realm to be the king's forest, and made stringent laws prohibiting

all persons from hunting, destroying trees or shrubbery, or committing any acts in such areas which would render the country less desirable for game and hunting. The early statutes punished the breaking of forest laws with death, putting out the eyes, etc., according to the nature of the offense.

Statutes in the thirteenth and fourteenth centuries greatly mitigated the severity of the old English laws, and modern statutes have reduced them to the plane of ordinary laws for the protection of property, with reasonable penalties for violation. Most of the area formerly included in the king's forest has been disafforested, and some tracts have been made into public parks. Hunting rights over lands owned in fee are still reserved and retained to a large extent by the English gentry, but this is either by reason of the original tenure or by special reservation in deeds of conveyance.

Laws to promote forest conservation have been adopted by nearly all civilized nations. They are concerned with the administration of forests in public ownership, the conduct of investigative and experimental forest work by the government, and the regulation and encouragement of forest conservation by private landowners.

United States.—Basic Federal forest laws in the United States, which authorize and define the powers and duties of the Government in forest protection and conservation, include: Acts of March 3, 1891, and of February 1, 1905, providing for the establishment of National Forests and their administration by the Forest Service of the Federal Department of Agriculture; Weeks Law (1911) providing for government purchase of lands for public forest purposes; Clarke-McNary Act (1924) providing for Federal cooperation with the States and with private owners in forest fire protection, reforestation, and dissemination of information on forestry; McSweeney-McNary Act (1928) authorizing extensive scientific research in silviculture, wood utilization, and other phases of forestry; Farm Forestry Act (1937) authorizing Federal cooperation in the development of farm forestry. A considerable body of additional statutes, decisions and regulations governs the National Forests, as part of the public domain, controlling lumbering, grazing, water power development, and the use of other resources of the forests. Commercial users pay a reasonable price to the Government; settlers and prospectors enjoy certain free privileges. Travellers and recreationists have free access, subject to certain restrictions.

The forest laws of the States are chiefly concerned with the organization of State forestry agencies, with the maintenance of State Forests, with taxation of forest lands, and with the promotion of forest conservation on private lands by cooperative fire protection, distribution of trees for planting, and by giving expert advice on forest management. Statutes in most of the States provide penalties for starting forest fires through wilful action or negligence. See FORESTRY. Consult B. E. Bernow, *Brief History of Forestry* (1913); J. P. Kinney, *Essentials of American Timber Law* (1917); Jenks Cameron, *Development of Governmental Forest Control in the United States* (1928); D. H. Smith, *The Forest Service* (1930); *Principal Laws and Regulations Relating to the National Forests* (U. S. Department of Agriculture).

Revised by C. E. RANDALL, *U. S. Forest Service.*

Forest Marble, a subdivision of the Oolitic rocks of the west of England, consisting of beds of clay, sandstone, and oolitic limestone. In some places it yields a shelly, fissile limestone, which has been cut and polished as an ornamental stone. The thickness of the series is estimated at 450 feet in North Dorsetshire, but near Bath it is only about 100 feet. It contains many shells of *Ostrea Pecten, Trigonia, Lima,* and other molluscs. The lowest portion of the forest marble is sometimes known as the Bradford clay. It is pale gray or yellow, and contains several seams of limestone.

Forest Park, village, Cook county, Illinois, on the Baltimore & Ohio Chicago Terminal, the Chicago Great Western, the Illinois Central, and the Minneapolis, St. Paul, & Saulte-Sainte Marie Railroads; 4 miles west of Chicago, of which it is a residential suburb. Pop. (1920) 10,768; (1930) 14,555.

Forestry is the management of forest land for the continuous production of its resources. It looks to the perpetuation of the forest and at the same time to securing full utilization of its products and services. Lumbering and forest utilization methods widely prevalent in the past and still prevalent throughout much of the United States have been on a liquidation basis, removing the merchantable timber with no effort to perpetuate the forest, often leaving the land unproductive and waste. Under forestry practice, however, the timber and other products are harvested, but the rate of cutting is adjusted to the rate of growth so that a given forest area will provide a continuing yield of timber. This method is termed by foresters 'sustained yield.' The sustained yield principle is applicable not only to timber but to wild-life, water, range forage, and all other products and services of the forest.

A number of specialized fields are included in the science of forestry. The branch of forestry dealing with the growth of timber is called *Silviculture.* It involves the improvement of timber stands by thinning or other cultural methods looking to production of maximum yields and quality of timber, the establishment of new stands by planting or seeding, and the securing of adequate reproduction after removal of timber. *Forest protection* is concerned with measures used in protecting forests from fires. *Forest economics* includes the determination of timber values, compilation of forest statistics, and the study of economic factors and trends in their relationship to forestry. Other specialized fields include: *Forest utilization,* which has to do with the efficient use of timber, naval stores, and other forest products; *Forest mensuration,* the determination of volume of timber in stands and the calculation of yields; *Forest range management,* the protection, maintenance, and efficient utilization of forest and wild land areas suitable for the grazing of livestock; *Forest wildlife management,* the protection and maintenance of game animals, fur-bearers, birds and fish, in relation to their forest environment; *Forest recreation management,* the planning, providing for, and regulation of recreational use of the forests; *Forest engineering,* the application of engineering work, including surveying and mapping, road and trail construction, etc., to management of the forests; *Forest entomology* and *Forest pathology,* having to do with the study and control, respectively, of insects and diseases affecting forest trees.

To obtain a sustained yield, the reproduction of forest stands after harvesting is secured by planting young trees, by sowing seed, by natural reseeding, or by sprouting. To cut, clear and then restock artificially by planting is a method much practiced in Europe, and one which has the advantage of establishing at once the species that are desired and of having the trees properly spaced for their best development. Artificial planting in America, however, has been confined largely to the reforestation

WAWONA FIRE IN SIERRA NATIONAL FOREST, CALIFORNIA. FIRES SUCH AS THESE WERE A MENACE TO THE PIONEERS WHO PUSHED WESTWARD TO POPULATE THE NORTH AMERICAN CONTINENT

FOREST FIRE AT NIGHT, COLUMBIA NATIONAL FOREST, WASHINGTON. BLAZES SUCH AS THESE CAN BE SEEN FOR LONG DISTANCES AT NIGHT, AND THE SMOKE THEY SPREAD IS OFTEN NOTICEABLE FOR A HUNDRED OR MORE MILES AWAY

BURNED TIMBER IN THE CLEARWATER NATIONAL FOREST IN IDAHO. FOREST FIRES HAVE RETARDED REFORESTATION OF VAST AREAS OF LAND IN THE UNITED STATES SINCE THE TREES WERE CUT DOWN IN LUMBERING OPERATIONS

Photos courtesy U. S Forest Service

Forestry

of lands denuded by destructive logging or by fire. The United States Government is planting from 100,000 to 150,000 acres a year in the National Forests, its reforestation work having been increased greatly since the establishment of the Civilian Conservation Corps in 1933. New York, Michigan, Pennsylvania, and several other States are planting on a substantial scale on state forest lands. A few private timberland owners have undertaken planting on cut-over or burned lands, and tree planting by farmers for farm timber production or for the establishment of windbreaks and shelterbelts has increased materially in recent years.

The methods of silviculture most practiced in the United States aim to secure reproduction from natural seeding. One method, followed in pine stands where the trees are practically all merchantable, is to cut all the timber except selected individuals or groups of trees which are left standing to seed the ground. This plan is successful only where the individual trees or groups are sufficiently firm-rooted to withstand the wind. It has been practiced in white pine stands in New England and in the Lake States, in the southern pine region, and in the Far West. It is not applicable to shallow-rooted trees like spruce.

Another method is to clear-cut restricted areas and to secure natural reproduction from a neighboring stand. These clearings may be in the form of strips or small blocks, the width of the openings depending upon the distance to which the seed from the neighboring stands can be carried by the wind. Good seeding of conifers can be secured over a distance representing one and a half to two times the height of the trees.

A third method and one most frequently employed is the so-called selection system, applicable where the forest is composed of trees of all ages and sizes mingled together. The cutting takes out only the larger mature trees, leaving the medium-sized and smaller trees for later cuttings, and natural reproduction takes place in the openings made by removing the old trees. Under this system the forest is cut over periodically but is never cut clear.

In the Douglas fir forests of the Northwest it has been found that there is a great deal of seed stored in the ground. When the cover is removed this seed germinates and an abundant reproduction is secured. This is also true of the white pine forests of Idaho. In most virgin forests the reproduction by natural means is a simple matter if fire is kept out, but where there is a mixture of species, the better kinds can be reproduced only through skillful cuttings designed to encourage those species which are desired.

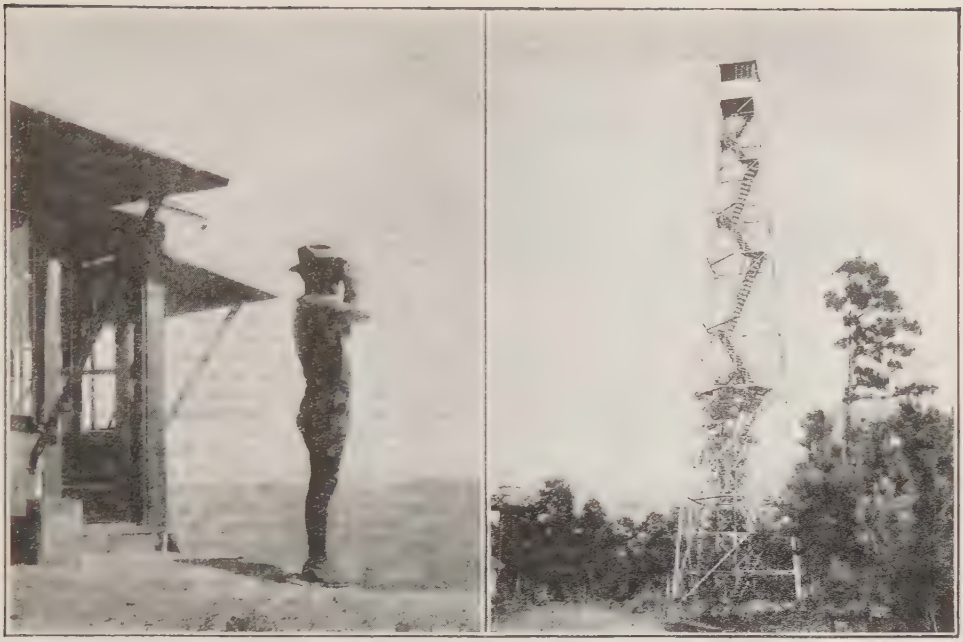
Natural reproduction is obtained also by the shelterwood system, under which a stand is removed by a series of from two to five cuttings, within a period of 10 to 30 years. The first cuttings are in the nature of thinning to permit the young seedlings to establish themselves, while the later cuttings remove the cover and leave a relatively even-aged stand of new trees. The presence of seed trees during the period of reproduction ensures a full crop. Where the cuttings are concentrated and groups of a quarter acre or so are cut, the method is called the group-system.

The various methods of natural reproduction are sometimes combined with planting to complete the reproduction or to introduce a certain proportion of species which are not secured by nature. In mixed hardwoods and conifers, a certain number of the best varieties may be planted in order to maintain a proper mixture.

Deciduous trees and a few conifers have the capacity of reproducing themselves by sprouts from the stump after cutting. Oak, chestnut, locust, poplar, elm, hickory, sycamore, ash and birch are among the hardwoods which sprout vigorously while the coast redwood is the principal coniferous species that develops merchantable trees from sprouts. Sprouts grow rapidly, but ordinarily the trees are not of such good form and quality or of such long life as trees from the seed. For reproduction by sprouting, called the coppice system, the stand is cut clear, usually before the trees reach the age of 40 years, and a new sprout stand results. In Europe 15 to 25 years are the common period rotation, since sprouting is most vigorous with young trees. A modification of the system called coppice with standards is to produce a certain number of older trees in mixture with the coppice. The standards, scattered among the smaller coppice, are allowed to grow to timber size. At the end of each sprout rotation the oldest of the standards are cut and are replaced by seedling trees. The other standards remain until mature.

The foregoing methods of silviculture concern the reproduction of forests. Where economic conditions permit, thinnings are made during the life of a forest stand in order to increase the rate of growth and improve the product. The suppressed and partially suppressed trees may be removed in order to give the dominant trees more room to spread and thereby stimulate their rate of growth, or the cutting may remove spreading trees of poor form, or species which themselves will have little value but which are crowding and injuring others of better quality. Where young plantations are over-topped by brush and fast-growing sprouts, the lopping of the branches and cutting out of the damaging trees and brush constitute an important cultural operation. The extent of thinning that can be undertaken depends upon the value of the prospective stand of timber, the possibility of selling a portion or all of the products, the cost of labor, and a variety of other conditions. Where the purpose of forest management is not primarily timber production but aesthetic and recreational, as in portions of the public forests, the cuttings are made in a way to preserve and improve the scenic values.

Forestry is peculiarly a public problem, not only because the forests render an important service to the public in conserving water resources, protecting mountain slopes, providing public recreation grounds and in other ways, but because the problem is such that the participation of the public is required even in connection with private lands. Thus it is only through public action that an adequate system of protection from fires can be obtained; the public must, furthermore, aid private owners by providing an equitable system of taxation and by demonstrating to them the best methods of silviculture. In some instances the public needs cannot be left wholly to private owners, and the nation or state must acquire and administer the land. Hence it is that many countries have developed a system of publicly owned forests. In France 35 per cent of the forests are owned either by the Government or communities, and in Germany 52 per cent of the forests are publicly owned. Elsewhere the percentage of forest under the ownership of the state, communities, or quasi-public institutions is: Norway, 21; Sweden, 24; Switzerland, 72; Belgium, 38; Denmark, 52; Japan, 62; the United States, 20. These public forests furnish a portion of the timber required in the respective countries, they serve to protect the mountain slopes and sources of streams, they are great public playgrounds, and they are the home



Photos by U. S. Forest Service.

1. Forest Service lookout at Fly Creek Point Lookout Station on the Challis National Forest, Idaho.
2. The Bethera fire tower and dispatcher's office on the Francis Marion National Forest, S. C.

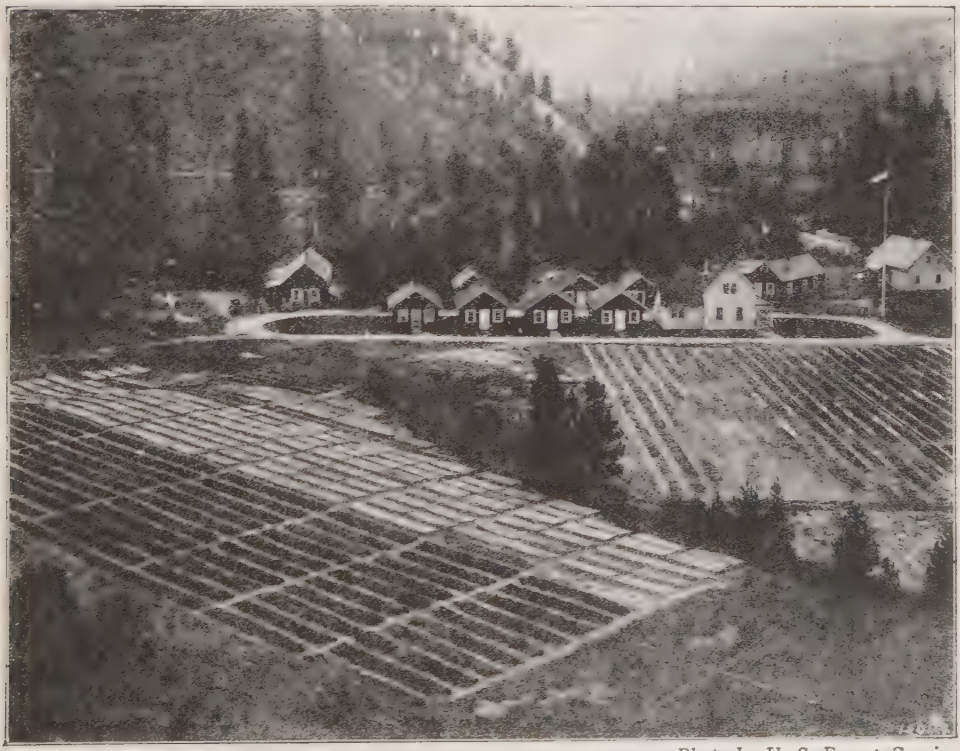


Photo by U. S. Forest Service

Savenac Forest Nursery, Lolo National Forest, Montana.

Here the Service has some 9,000,000 small seedling trees to be set upon denuded forest lands. These nurseries help to set up to 150,000 acres yearly.

of wild life. Further, and equally important, they serve as demonstrations of forestry to private owners and they aid in stabilizing the industries that depend upon their products. The best results are secured when the public owns or controls 35 per cent or more of the forest land, and the public reservations are well distributed.

Forestry in the United States.—While forestry is a comparatively new undertaking in the United States, a great deal has been accomplished in the way of public forestry since the beginning of the twentieth century. The achievements in private forestry are, however, exceedingly small. The first forward step was taken when the Federal Government inaugurated a policy of setting aside portions of the public domain as permanent reservations to be handled in the interest of the whole nation. The first legislation was enacted in 1891, but it was not until 1897 that Congress gave adequate recognition to the policy of providing the authority and means to protect and administer the reservations; and it required the initiative and courage of President Theodore Roosevelt to build up the system of public forest reserves that exists today.

The Federal reservations are called National Forests and comprise over 175,000,000 acres of land, located chiefly in the mountains of the Far West and Southeastern Alaska. There are also small National Forests in a number of the Eastern States, most of these having been acquired since 1911 under the Weeks Law providing for the purchase of private forest lands for public forest purposes. The National Forests are distributed as follows:

Alabama, 370,000 acres; Alaska, 21,348,000; Arizona, 11,400,000; Arkansas, 2,024,000; California, 19,452,000; Colorado, 13,630,000; Florida, 1,317,000; Georgia, 566,000; Idaho, 19,884,000; Illinois, 172,000; Indiana, 34,000; Iowa, 100; Kentucky, 393,000; Louisiana, 492,000; Maine, 48,000; Michigan, 1,775,000; Minnesota, 2,385,000; Mississippi, 939,000; Missouri, 1,090,000; Montana, 16,218,000; Nebraska, 206,000; Nevada, 4,988,000; New Hampshire, 663,000; New Mexico, 8,558,000; North Carolina, 912,000; North Dakota, 480; Ohio, 34,000; Oklahoma, 150,000; Oregon, 13,790,000; Pennsylvania, 432,000; Puerto Rico, 25,000; South Carolina, 520,000; South Dakota, 1,080,000; Tennessee, 530,000; Texas, 640,000; Utah, 7,662,000; Vermont, 160,000; Virginia, 1,291,000; Washington, 9,033,000; West Virginia, 891,000; Wisconsin, 1,320,000; Wyoming, 8,644,000.

The National Forests were set aside as public properties to be used and developed in the permanent interest of the whole nation, and are today rendering this service. The timber is utilized under approved methods of forestry and the other resources are made available for use under conditions that safeguard the public interest. There is a competent fire protective system; over 800,000,000 feet of timber is cut each year; over 7,000,000 head of livestock utilize the grasses under a regulated system of grazing; agricultural lands are used for settlers; the development of *bona fide* mining is encouraged; water power sites are made available; roads and trails are opening up virgin country; and many millions of people use the forests for recreation. The National Forests are on an efficient basis of financial administration. Already they produce a gross annual income of approximately $5,000,000, or about the cost of protection and administration, that is, the operating cost not including capital charges for improvements or special expenses of the settlement of land titles, surveys, research, etc.

The National Forests are under the administration of the Forest Service of the Department of Agriculture. In addition to the task of handling the Federal forests, the Forest Service is charged with promoting forestry throughout the country. This it does through well organized research work conducted at local field stations, through public education, and through cooperation with the States and private agencies. Largely under the stimulus and leadership of the Federal undertaking various of the States have established central agencies charged with the forest interests within their borders.

Originally the individual States owned a considerable amount of forest land. In most instances they have disposed of their land with the same lavish hand as the Federal Government in the last century. The result is that only a few of the western States have now any considerable amount of what was originally owned, and not all of these have adopted a policy of holding their forests permanently. A number of the States, however, are now undertaking to build up state forests through the purchase of private lands. New York, Pennsylvania, Michigan, Minnesota, Massachusetts, New Jersey, Ohio, South Dakota, Connecticut, Indiana, Louisiana, Maryland, New Hampshire, North Carolina, Vermont, Wisconsin, and the Hawaiian Islands have well developed state forest systems. Several other States have considerable areas of forest land in state ownership, mostly acquired through tax delinquency, but which are not being managed under policies of permanent administration. Arizona and New Mexico have certain areas of State land intermingled with National Forest land, and under the law administered in the interest of the States by the Federal Government. Many of the States have State Parks which are devoted wholly to recreation and the preservation of scenic features.

Altogether forty States have provided for a state forest organization of some kind. Most of their efforts are devoted to fire protection, to co-operation with private owners, and to the extension of an interest in forestry among the people. Altogether the States are spending each year for fire protection about $4,000,000, and the Federal Government contributes about $2,000,000 in addition to aid them. Though this sum seems large in the aggregate, it is nevertheless small when measured by the magnitude of the undertaking and the values involved. The forest fire menace has by no means been mastered, as is evidenced from the fact that there are still over 170,000 fires every year which burn over 35,000,000 acres, and cause a property loss of approximately $50,000,000. More than 200,000,000 acres are wholly without organized protection from fire, and on much the protection is inadequate. (See FOREST FIRES.)

There is now a body of professional foresters in the United States, and excellent instruction in Forestry is offered at a number of institutions. Among the older forest schools are those at Yale, Cornell, and Syracuse Universities, at Pennsylvania State College, and at the Universities of Michigan, Minnesota, California, and Washington. In addition, the land grant colleges in Maine, New Hampshire, Massachusetts, Georgia, Iowa, Oregon, Montana, Idaho, Colorado, and Michigan, offer a full training in forestry; and special work in forestry is given at Harvard University and at a number of other collegiate institutions.

For Forestry in Canada, see CANADA, FORESTRY. See also FORESTS, and sections on Forestry in articles on individual countries and States.

Bibliography.—Consult the publications of the U. S. Forest Service; Reports and Circulars

FOREST OFFICER STAMPING PONDEROSA PINE LOG IN FAYETTE NATIONAL FOREST, IDAHO

Photos courtesy U. S. Forest Service

MARKING TIMBER IN THE MEDICINE BOW NATIONAL FOREST IN WYOMING

FOREST RANGERS INSPECTING AND MARKING TIES BEFORE THEY LEAVE THE WYOMING NATIONAL FOREST

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Revised by C. E. RANDALL, *U. S. Forest Service.*

Forestry Association, American, an organization formed in 1875 and incorporated in 1897 for the promotion of the wise use and conservation of forests through legislation and popular education. It publishes an official organ, which has been successively called *The Forester, Forestry and Irrigation, Conservation, American Forestry* and *American Forests.* Offices are maintained in Washington, D. C.

Forestry Association, Canadian, an association instituted in 1900 to foster public interest in the conservation and development of the forest reserves. The head office is in Ottawa.

Forests. As ordinarily used the term 'forest' is applied to an area well stocked with trees. Technically a forest has a greater significance than a mere aggregation of trees. A forest is a community of individuals each struggling for space, light, and nourishment, and each reacting on its neighbors in various ways. As a community the forest has a distinctive life, character, form, growth, yield, and influence on environment. The forest primæval represents the ultimate product of undisturbed natural forces. It is nature in equilibrium. In such a forest one finds trees of all ages and sizes mingling more or less promiscuously. Individual trees mature, die, and make way for others. The amount of growth each year is about offset by decay. It is seldom, however, that extensive areas of forest escape the action of destructive agencies. Unusual wind storms sweep broad paths through the forests; fires, often set by lightning, clear off areas of greater or less extent; and insects frequently wipe out whole stands. Nature tends to repair such devastation, and the cleared areas gradually are restocked, often with stands of different composition, but these, if undisturbed, in turn assume the irregular character and form of their predecessors. With the advent of man comes a new destructive agency. In pioneer countries his methods of exploitation are crude and without thought of forest perpetuation. He leaves slash in the forest and permits fires to run unheeded. If seed trees are left or the cutting is not too heavy, and if the forest escapes the fires, a new growth is gradually restored. Too often, however, fires follow lumbering and cause extensive devastation.

In humid regions the trees grow in dense masses, completely shading the ground. In semi-arid regions the growth is more sparse, and the trees stand so far apart that in many cases the crowns do not meet. These open forests—the term forest is still applicable here—are common in parts of the southwestern United States. Other areas in the West are covered with a dense growth of low trees, often not over 15 feet high, like the chaparral of Southern California. The ground is more or less completely covered, humus is formed, and there is a favorable action upon the prevention of erosion and upon conservation of water. In America such growths are called *chaparral forests;* in England they are known as *scrub forests.* With the advent of forestry, *i.e.,* the scientific development and management of forests, areas of considerable size are set aside as public reservations, the term forest being applied to a specified area that has been placed under administration, though this may include, in the aggregate, many areas that are treeless or devoted to other uses than tree growth. Hence the terms *National Forest* and *State Forest.* In Europe the word forest was originally applied to areas set aside for hunting. This is now of historic interest only or may have a legal significance in connection with old land titles.

Forests render an important service to a nation, state, or community. In the first place they furnish an essential raw material that enters most intimately into the everyday life of a people. The forests of the United States support a vast industry engaged in producing, manufacturing, and distributing lumber and its products (see LUMBER.) Again, they make lands productive and useful that are not suited to other purposes and thereby help by taxation to sustain local communities; they protect slopes from erosion, help to conserve water resources, ameliorate extremes of local climate, check snow slides, and fix river banks and drifting soils; and finally they are of great value as public recreation grounds and as the home of useful wild life. Well managed forests are essential to a nation's prosperity and to the convenience and comfort of its people. The consequences of forest destruction are many and far reaching. The United States is already beginning to feel the injurious effects of its failure to safeguard this natural resource.

Forests of the World.—The distribution of forests is governed largely by moisture and temperature. It is because of lack of moisture that every continental country has a large interior area without forests. Temperature is the principal factor limiting forest growth in northern latitudes and high altitudes. Regions with sufficient moisture were originally covered with practically unbroken forests, such openings as occurred being due to local conditions of soil and to such destructive agencies as fire, wind, and insect depredations.

There is great variation in the character of the forests growing under different conditions of climate and soil, forests differing in component species, in size of timber, form of stand, quality and yield of products, and other particulars. The largest number of species occur where conditions of temperature and moisture are most favorable. Near the limits of the forests at high latitudes and in the mountains, and in the interior of continents, the number of species drops off. In cold climates and in most semi-arid regions coniferous trees predominate. Near the equator and in regions supplied with adequate moisture, the number of species increases and the conifers are reduced in numbers and extent of area, or are entirely absent. Thus, in the northern countries—Northern Canada and portions of the Northern United States, Alaska, Siberia, Northern Russia, Finland, and Scandinavia—there is a broad belt of forests with a predominance of coniferous trees. In the great temperate belt, forests are composed of mixed hardwoods and conifers, either predominating as the local conditions are especially favorable for their growth. In the tropics, wherever the rainfall is heavy, the hardwoods grow in great variety and profusion.

The temperate forests have been of the greatest service to man, as they contain species of high utility. Of special service are the light, easily handled, and

HEELING-IN BED IN NORTH CHEYENNE PLANTATION. PIKE NATIONAL FOREST COLORADO. AFTER THE TREES ARE HEELED IN THE STOCK IS DONE UP IN BUNDLES FOR PACKING INTO FIELDS

PLANTING YOUNG TREES IN THE WASATCH NATIONAL FOREST IN UTAH. THE REFORESTATION DRIVE IN THE UNITED STATES HAS BEEN GIVEN GREAT IMPETUS BY FLOODS AND DROUGHTS IN RECENT YEARS

PLANTATION OF PONDEROSA PINE IN LOLO NATIONAL FOREST IN MONTANA. THESE TREES HAD BEEN PLANTED ELEVEN YEARS BEFORE THE PICTURE WAS TAKEN IN THE U. S. GOVERNMENT'S FORESTRY AND CONSERVATION DRIVE

All photos on this page courtesy U. S. Forest Service

Forests

easily worked timbers of the pines, spruces, firs, and other conifers, which constitute the principal material used in building and for a great variety of implements and articles of everyday application. There are, however, many hardwood species of equal utility, especially where strength is required and for articles demanding special qualities.

North America has been looked to as an inexhaustible source of timber for the world, but already the United States is embarrassed because of the increasing prices and scarcity of lumber due to the exhaustion of the great coniferous and hardwood virgin forests of the eastern part of the country. The Canadian forests are extensive in area, but in many places the timber is small, and enormous stretches of land have been devastated by forest fires. Eastern Canada will need practically all of the lumber it can properly cut to supply its great lumber and paper manufacturing industries, and though Canada can for some time export lumber from British Columbia, she will soon, with the development of agriculture and other industries, absorb a large part of the products of her own forests. Western Europe already has a deficiency of forest products, greatly enhanced by the drain upon the forests during the World War. It is said that along the fighting zone of Russia some 16,000,000 acres of forest were practically ruined during the early years of the conflict. About 1,250,000 acres of French forest land were devastated in the zone of fighting, and the forests in other parts of France were greatly depleted to supply the needs of the French and Allied armies. At the close of the war more than 50,000 men were engaged in cutting in the French forests for barracks, hospitals, warehouses, transportation needs, etc. The meagre forests of England and Scotland were also very largely cut out during the war, while Norway and Sweden over-cut their forests and will have little to spare until they can be brought back to normal yield. The Swiss forests were also over-cut, and the forests of Germany and Central Europe, while not as heavily drawn upon as those of France, were nevertheless considerably depleted and will require time to recover. The same is true of Italy and the Mediterranean countries.

Finland and Northern Russia have a large amount of forest land, but much of the product is required in the development of those countries and to supply Western Europe. Much has been said of the enormous forests of Siberia, but it should be borne in mind that the timber in that region is small, being comparable to that in Northern Canada and Alaska, and that it will probably not be sufficient to supply much more than the needs of local development.

In some of the tropical countries there is a large aggregate amount of timber, as in the Philippines, portions of India, Borneo, and Sumatra, and the nearby regions, portions of Africa, and the rain belt of South America. There are, however, generally speaking, two great difficulties in developing these tropical forests—the absence of coniferous species and the difficulties of exploitation. It has generally been thought that the tropical woods would not be suitable as substitutes for the temperate timbers, but recent studies are showing that there are a considerable number of tropical species which have qualities analogous to some of the more common temperate hardwoods, such as ash, oak, hickory, elm, and walnut. With a better knowledge of how to season and handle the lumber and with the application of engineering skill in its exploitation, it is probable that in the future tropical wood can be utilized extensively for many common purposes as in the manufacture of furniture, agricultural machinery and implements, vehicles, etc. The remoteness of the forests and the cost of exploitation and transportation will, however, always prevent their rendering to the people of temperate regions that service which is fulfilled by extensive local forests.

In Europe the forests cover about 750,000,000 acres, or approximately one third of the land area. Of this over three-fourths is in Russia, Finland, Sweden, and Norway. The country of Europe having the largest percentage of forests is Finland, where about 54 per cent of the land area is wooded. Great Britain and Portugal have the smallest percentage of forest land, the former 4 per cent and the latter 5 per cent, while Germany has 26 per cent, France 19 per cent, Belgium 17 per cent, Italy 14 per cent, Spain 13 per cent, and Holland 7 per cent.

The total forest area of North America aggregates about 1,250,000,000 acres. This includes, however, some 300,000,000 acres of very small timber in the interior of Alaska and Northern Canada. Asia is credited with more than 1,500,000,000 acres of forest land of which more than half is in Asiatic Russia. Africa has an area of forest as large as that in Europe, while tropical America has probably over 2,000,000,000 acres that may be classed as forest.

Forests of the United States.—The United States is naturally endowed with forests unexcelled anywhere, the wide climatic range and the excellent conditions of moisture and temperature furnishing unusually favorable conditions for tree growth. Originally there was an almost unbroken forest from the Atlantic Ocean to the Mississippi Valley, while in the north the forests extended almost to the western boundary of Minnesota, and toward the south to the ninety-fifth meridian. At the western boundary of this great forest there were open areas, as for instance in Illinois, due chiefly to forest and prairie fires, which caused a replacement of the trees by grass vegetation. Immediately west of this broad forest belt occurs the prairie region through which strips of forest ramified out along the streams. West of the hundredth meridian and extending to the Rocky Mountains and their outlying ranges, are the great plains, which were practically treeless except on certain elevated areas, as the Black Hills, where the moisture was sufficient to support a forest. Forests occur naturally through most of the Rocky Mountain ranges, dense and heavy in the northern portion, but more or less broken and interrupted throughout the central and southern areas. West of the Rockies is another broad band of grass country, narrow to the north and broad in the Great Basin. The ranges of the Pacific Coast are naturally clothed with forest, exceedingly dense in the northern portion, interrupted in some of the valleys of Oregon, and in California running down the coast ranges and the Sierra Nevada Mountains, with grass land on the floor of the great river valleys.

Altogether the original forests covered about 825,000,000 acres, in addition to from 100,000,000 to 150,000,000 acres of open woodland, such as occurs in the foothills of many of the western mountains. On account of the wide range of climate, the American forests are widely diversified in character and composition. There are no less than 800 arborescent species, of which fully 100 have a recognized high economic value, and an additional 200 are of greater or less importance in forest management. The greatest single factor in the economic importance of the forests is the presence of a large amount of

coniferous timber favorably located with reference to the needs of the population and industries. About three quarters of the merchantable timber of the United States standing today consists of coniferous or so-called softwood species.

The great prairies and plains of the interior separate the forests of the United States into two distinct regions, differing in species of trees and in general character as well. The eastern forest is composed of a mixture of conifers and hardwoods; the western forests are almost wholly coniferous. In N. New England and New York the predominating species are conifers, spruce, hemlock, balsam fir, and white pine, with individuals and stands of birch, maple, and beech, and scattered specimens of other species. To the southward and at lower elevations conifers become less abundant, some species disappear, and oaks, hickories, ash, elm, and chestnut mingle with maple, birch and beech. (Recent spread of a fungus disease has killed much of the chestnut). A similar type of forest occurs in the northern Lake States. There, however, the land is less mountainous, and the spruce and balsam forests occupy the low moist lands, while the broad sand plains were originally covered with a magnificent body of white and red pine.

Stretching from southeastern New York over the Appalachian Mountains and west to the Mississippi River, occurred one of the most magnificent hardwood forests of the world. In many places, especially in the mountains and rugged portions of the lower country, there were conifers in mixture. On the rich lands, later cleared for agriculture, occurred oak, hickory, walnut, tulip poplar, ash, basswood, beech, and many other species, with trees of magnificent proportions and lumber of high quality. It was this forest that constituted the basis of the great wood-using industries of the Central West. East of the Appalachian range, in the Piedmont plateau, the forest was chiefly a mixture of hardwoods of the oak, chestnut, and hickory type, mixed with short-leaf, loblolly, and similar pines; and along the coast from North Carolina to eastern Texas the great coastal pine belt is characterized by the predominating yellow or long-leaf pine. Along the rivers in the South are bands or often wide expanses of low lands with hardwood forests in which a great variety of species occurs. It is in such areas that one finds the red gum that is now of such high commercial value.

In the Far West the most valuable forests are near the coast. West of the Cascade Mountains in Washington and Oregon occur the Douglas fir forests, which have become the most important center of lumber production in the country. The Douglas fir is mixed with western hemlock and in places with Sitka spruce, western cedar, and some other species. In the Sierra Nevada Mountains in California the sugar and Ponderosa pine are the principal trees, with occasional areas of giant Sequoia and an intermingling of various other distinctively western species, while along the coast range from Oregon south to central California occur the coast redwoods that to many are the most impressive of all the world's forests.

The Rocky Mountain forests are less dense and are composed of smaller trees than the coast forests. In Northern Idaho and Western Montana, where there is abundant moisture, the forests are heavy, the most conspicuous tree being the western white pine. The mountains of eastern Oregon and Washington are clothed chiefly with Ponderosa pine, with areas of lodgepole pine and other conifers.

The present forest area in the United States is approximately 463,000,000 acres, not including the low grade woodland and scrub located in the southwestern mountains. Of the remaining forest area, only about 22 per cent, or 100,000,000 acres, can be classed as virgin forest, and even this area has been greatly broken by forest fires and other injuries. Of the remainder, about 112,000,000 acres contain a certain amount of saw timber, largely second growth; 174,000,000 acres are covered with more or less small timber below merchantable size; and approximately 77,000,000 acres have been so seriously devastated as to be substantially waste land.

The yellow pine forests of the South represent the last remaining large body of coniferous timber in the East, and this is now being so rapidly depleted that little virgin forest remains, although second-growth timber is growing rapidly where fire is kept out. The hardwood forests in the Central States have also been largely depleted, only remnants of the original forests now occurring in small tracts. There is a certain amount of virgin hardwood timber in the southern swamps and in the Appalachian Mountains, but much of the high grade oak, hickory, ash, tulip poplar, walnut, and other timbers has been cut out. The bulk of the virgin forests of the country now remaining are in the Far West. On nearly one-fifth of the present forest area there is practically no forest reproduction. The devastation has been most extensive in Pennsylvania, the northern Lake States, the pine region of the Southeast, and portions of the Far West.

There is land enough in the United States, not suitable for other purposes, to produce by growth more than enough timber to meet the requirements of the country. The lack of adequate fire protection and failure to use the proper methods of forestry result in a continued deficiency as between consumption and production by growth. The total amount of material grown in the forests each year is an equivalent of not over one-half of the amount of material that is used or one-fourth of the annual drain from all causes.

See also Forestry and bibliography there cited.

Revised by C. E. Randall,
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Forests, Fossil. See Fossil Forests.

Forests, Submerged. See Submerged Forests.

Forez, fô-rez', Monts du, range of mountains, departments Loire and Puy-de-Dôme, France, between the Rivers Loire and Allier. The highest peak is Pierre-sur-Haute (5,280 ft.).

Forfar, fôr'-fâr, county town and royal burgh, Forfarshire, Scotland; 21 miles N. by E. of Dundee by rail. Forfar Loch lies west of the town and near by is Kirriemuir, the 'Thrums' of Barrie's tales. The site of the old castle demolished by Bruce in 1308 is marked by a town cross. Linen and jute are manufactured, and bleaching and tanning are of importance. Pop. (1931) 9,660.

Forfarshire, or Angus, maritime county in the eastern part of Scotland, north of the Firth of Tay, east of Perthshire, west of the North Sea, and south of Aberdeen and Kincardine, with an area of 873 square miles. The surface is varied; in the north and south are lofty hills, while between lies the fertile valley of Strathmore. On the eastern and southern coasts the land is level and highly cultivated. Granite and sandstone are quarried; cattle raising and sheep breeding are extensively carried on; while the principal manufactures are linen, jute, canvas, and sailcloth. Shipbuilding is carried on at Dundee, and Montrose is the center of the fishing industry. Pop. (1931) 270,190.

Forfeiture derived from the word forfeit means 'to lose' and is frequently used as synony-

mous with fine or penalty. It is a divestiture of property without compensation in consequence of an offense. Its effect is to transfer the title to the specific thing from the owner to the Sovereign power. The forfeiture and resultant disabilities imposed by the common law on persons attainted of felony are unknown to American law, although under both Federal and state laws, forfeitures are sometimes expressly provided for by way of punishment for the violation of certain statutes (*e.g.* relating to the preservation of game, prohibiting gambling, etc.).

In all forfeitures accruing at the common law, some legal steps had to be taken before the property vests in the government. Where forfeiture is declared by the statute, the common law rules may be dispensed with, and title to the property vests immediately on the doing of a certain act. Under Federal law, to determine the proper tribunal, there must be a seizure, and the method of procedure is by libel or information, which must contain a substantial statement of the offense. Trial is by a court sitting as a court of common law from which appeal may be taken, and, in certain cases, remissions of pecuniary penalties granted.

Forgery is the false making or material alteration of a writing to the prejudice of another's rights. Uttering a forged writing consists in offering to another a forged instrument with knowledge of the falsity of the writing and with intent to defraud. Fraudulent intent is of the essence of forgery. It is sufficient if the resemblance between the counterfeit and the genuine instrument or signature is such as to deceive a person of ordinary observation.

In order to constitute a forgery a writing or instrument must be such that, if genuine, it would have some efficacy as affecting some legal right. A false order or request for the delivery of goods or merchandise, with an express or implied undertaking on the part of the purported writer to pay therefor, constitutes forgery. Nor is it essential that the person in whose name the instrument purports to be made have the legal capacity to make it. To constitute forgery, the accused need not have signed the instrument in person; it is sufficient if he caused it to be signed by another even though the latter was entirely innocent of criminal knowledge or intent.

Forgery, Literary. See Literary Forgeries.

Forget-me-not, the name applied to the various members of the genus Myosotis, a subdivision of the order Boragina, which is of wide geographic distribution. They are low growing herbs, diffuse or erect, and perennial or annual. The leaves are alternate with entire margins and the flowers, a beautiful blue in color, with a five-cleft calyx and a salver-shaped corolla. The True Forget-me-not (*M. palustris*) is a fairly common European plant occurring in ponds and streams in summer and early autumn, and has become naturalized in the United States, where it may be found in brooks and other damp places from Maine to Pennsylvania. Other species are the Smaller Forget-me-not (*M. laxa*), which occurs in Europe and Asia, and in the United States as far south as Virginia and Tennessee; the Alpine Forget-me-not (*M. alpestris*), a compact little rock-plant, which is covered with blue flowers in spring; *M. dissitiflora,* which blooms early and for a long period, and which is probably the most valuable species for garden decoration; and the European *M. sylvatica,* extensively used for bedding.

Forging, the working into special shape of iron or steel when it is at white heat, and therefore in a malleable state. It may be done by hammers, operated by hand or power or by the use of the hydraulic press. See Steam and Pneumatic Hammers; Hydraulic Machinery.

Forgotten Man, The, a phrase uttered by President F. D. Roosevelt in a speech at St. Paul, Minn. This phrase, however, had been coined half-a-century earlier, by the late Professor William Graham Sumner of Yale, who first gave a lecture on the subject in 1883. In a scathing castigation of political jobbery, he said: 'Now who is the Forgotten Man? . . . You will find him hard at work because he has a great many to support. . . . The Forgotten Man is delving away in patient industry, supporting his family, paying his taxes, casting his vote, supporting the church and the school, reading his newspaper, and cheering for the politician of his admiration, but he is the only one for whom there is no provision in the great scramble and the big divide . . . generally he pays—yes, above all, he pays. . . . All the burdens fall on him, or on her, for it is time to remember that the Forgotten Man is not seldom a woman. . . .'

Fork, an instrument made from various substances—usually metal—terminating in two or more elongated points called prongs. The use of the fork as a table adjunct seems to have originated in Italy, whence it was carried to England, though its use there did not become well established before the end of the seventeenth century. The term fork is applied also to a pronged agricultural implement used for tossing, carrying or lifting, as a pitchfork or hay fork; and to a small percussion instrument used to measure the pitch of musical tones (see Tuning Fork).

Forlì, fôr-lē', province of Middle Italy, reaching from the Tuscan Apennines to the sea, and having the province of Ravenna on the north and the province of Florence on the west. The lowlands are fertile and productive. Silk is produced. Area, 730 square miles. Pop. (1936) 444,528.

Forlì, town and episcopal see of Italy, capital of the province of that name, stands at the north foot of the Apennines; 40 miles by rail S.E. of Bologna. Among the places of interest are the church of San Mercuriale, the Palace del Municipio, the Cathedral of Santa Croce, rebuilt since 1844, and the Ginnasio Comunale, which contains the municipal art collections. The Citadel, built in the fourteenth century, is now used as a prison. Manufactures include silk, hats, furniture and pottery. Forlì is said to have been founded in 188 B.C. by Livius Salinator. In 1504 it was annexed by Pope Julius II to the States of the Church. Pop. (1936) 65,683.

Form, in music, is the name given to the general plan upon which a composition is constructed. Each species of musical composition contains certain distinctive features which constitute its *form.* Among important determining factors may be mentioned the order of succession of various movements; the predominating characteristics of these movements, and the distribution of subjects and their key relationship. See Music.

Formaldehyde, Methanal (HCHO). A colorless gas with a distinctive odor, having an irritating effect on the mucous membranes. Commercially it is prepared by passing the vapors of methyl alcohol and air through a tube containing copper gauze or metallic silver held at a temperature of 300° centigrade. It is also produced by heating certain formates which are usually prepared by the action of carbon monoxide, under pressure, upon metallic oxides. Water will dissolve as much as 52 per cent of the gas but such concentrated solutions undergo polymerization on standing, forming an insoluble paraformaldehyde (CH_2O).

Formaldehyde gas is evolved from the solid para form upon heating. For disinfecting purposes the para is often heated in little burners or made into candles, in which part of the para burns and part is converted to formaldehyde.

Commercially formaldehyde is sold in solutions of 35–40% strength known as Formalin. To prevent polymerization the solution contains a certain amount of methyl alcohol. Formalin is a colorless fluid of pungent odor and caustic taste, whose vapor or solution is a powerful irritant to the skin and mucus surfaces. It is poisonous and is used as a germicide and fungicide on plants and vegetables. In a 2% solution spray or vapor, it is useful as a disinfectant for clothing, rooms and instruments.

Formaldehyde combines readily with almost every class of organic substances. Most important is its use in the manufacture of synthetic resins such as Bakelite, a phenolformaldehyde resin formed by the reaction between phenol (Carbolic Acid) C_6H_5OH and formaldehyde in the presence of ammonia. Such resins are used to manufacture various molded products such as fountain pens, toy parts, light switch face plates, etc. The other important resin is that formed by the reaction of formaldehyde with an acqueous solution of urea $CO(NH_2)_2$ to yield a water soluble product used as plywood adhesive, paper coating and fabric stiffener or crease preventive. The major part of formaldehyde production is used in resin products.

Formaldehyde compounds are used in medicine locally and internally as antiseptics. Thus Urotropin, a compound of formaldehyde and ammonia called Hexa-methylenetetramine $(CH_2)N_4$, is used for diseases of the urinary tract. As local antiseptics compounds of formaldehyde with gelation (*Glutal*), tannin (*Tannoform*) and starch (*Amyloform*) are in use. Formaldehyde is used in many industries for various purposes: thus in agriculture it is a fumigant and fungicide; in brewing it is used to stimulate fermentation. It is used as a developer and hardening agent in photography, as a latex coagulant in the rubber industry, and as an important substance in the manufacture of many commercial chemicals.

It is believed that in Photosynthesis, formaldehyde is the first product formed from the carbon dioxide of the air by Chlorophyll of green plants and that the formaldehyde polymerizes to form glucose $C_6H_{12}O_6$.

Forman, fôr'man, HARRY BUXTON (1842–1917), English author and editor, was born in London and educated at Teignmouth. He entered the Civil Service in 1860, becoming Secretary of the General Post Office and Controller of Packet Service, from which he retired in 1907. Especially notable are his editions of Shelley (1876–80) and Keats (1883). Besides these he has published *Our Living Poets* (1871); *Letters of John Keats to Fanny Browne* (1878); *The Shelley Library* (1886); *Elizabeth Barrett Browning and her Scarcer Books* (1896); *Books of William Morris* (1897); *Letters of Edward John Trelawney* (1910); *Note Books of Shelley deciphered, with commentary* (1911); *Medwin's Life of Shelley* (1913).

Forman, JUSTUS MILES (1875–1915), American author, was born in Le Roy, N. Y. He was graduated from Yale (1898), and studied painting in Paris under Bouguereau (1898–1901). He was one of the victims of the sinking of the *Lusitania*. Besides numerous magazine stories, he published *The Garden of Lies* (1902); *Journey's End* (1903); *Monsigny* (1904); *Buchanan's Wife* (1906); *A Stumbling Block* (1907); *Jason* (1909); *The Unknown Lady* (1911); *The Opening Door* (1913); *The Blind Spot* (1914); *The Twin Sisters* (1916).

Forma Pauperis, fôr'ma pô'per-is, IN, a phrase in jurisprudence meaning 'in the character of a poor man.' If a person is so poor as to be unable to bear the cost of suing at law or in equity, upon making oath that he is not worth five pounds and obtaining a certificate from an attorney that he believes him to have a just cause, said person is permitted to sue 'in forma pauperis,' that is, he is allowed to have original writs and subpoenas, and counsel assigned to him, all without cost. In the United States it is considered a part of the common law of the several States although in many it is governed by statute.

Formic Acid, (HCOOH) (methanoic acid) m.p. 8.40 C., b.p. 100.7° C., Density 1.22 at 20° C. A colorless liquid and first member of a homologous series of compounds known as the fatty acid series. The name fatty acid comes from two of the higher members of the series, palmitic and stearic acids, which are prepared from animal fats. Formic acid occurs in nature in nettles and red ants and was discovered in 1670 by Rey who distilled red ants with water. Early chemists used this method to prepare formic acid for the laboratory.

Commercially, formic acid is prepared by the action of Sulphuric acid (H_2SO_4) upon Sodium formate (HCOONA). Sodium formate is made by the action of Carbon Monoxide (CO) under 6 to 10 atmospheres of pressure and at 200° centigrade, upon Sodium Hydroxide (NaOH). Formic acid is also made by heating oxatic acid $(COOH)_2$ and glycerol $C_3H_5(OH)_3$ and distilling over the formic acid and water formed.

Formic acid decomposes at 160° C. to form hydrogen and carbon dioxide. It is a strong reducing agent, a powerful antiseptic and is used in the textile industry as a mordant and dyeing assistant, in brewing as a yeast antiseptic, as a food preservative, and as a starting point in the production of formates.

Formicidæ, the ant family. See ANT.

Formo'sa, or TAIWAN, an island in the China Sea, off the coast of Fu-kien, China, from which it is separated by the Strait of Formosa (90 to 220 miles wide). It lies between lat. 25° 15′ and 20° 56′ N., and long. 120° and 122° E.; its greatest length is about 235 miles; its greatest width, 90 miles; and its total area, 13,890 square miles. To the south are the Philippines, and to the northeast the Loochoo Islands.

Physical Features.—Formosa is traversed from north to south by a series of forest-covered mountain ranges, culminating in Mount Morrison (14,270 feet), renamed by the Japanese Niitakayama, and Mount Sylvia or Setsu-zan (12,480 feet). From the western foothills a broad stretch of lowland, watered by a number of short streams, extends to the coast. Eastward the mountains continue to the shore, where magnificent cliffs rise sheer from the water to heights of from 3,000 to 5,000 feet.

The climate, on the whole, is damp, hot, and malarious. During the southwest monsoon, which prevails from May to November, the north of the island enjoys pleasant weather, while the south is excessively rainy. The northeast monsoon, from November to April, is accompanied by heavy rain in the north, and mild, pleasant weather in the south. The mean temperature ranges from 61° F. for February to 81° for July. The annual rainfall varies between nearly 200 inches in Kelung, the rainiest city in the Far East, and 54 inches in Tainan. Severe ty-

Formosa

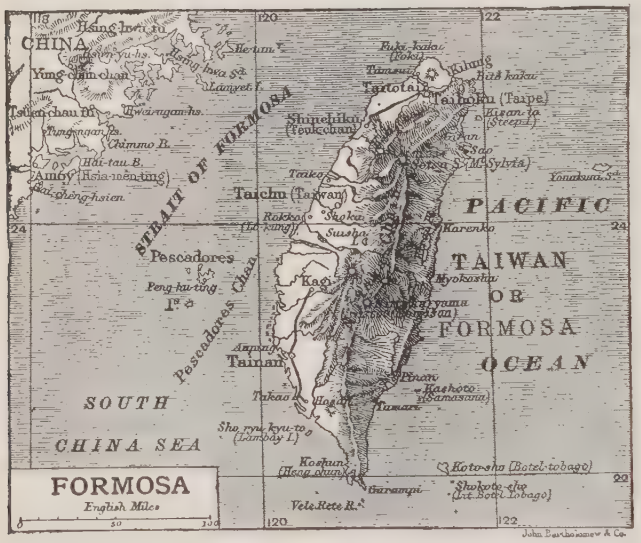
phoons occur in August and September.

As the Tropic of Cancer passes almost through the center of the island, both climate and vegetation are tropical. About 20,000,000 acres are covered by tropical forest and bamboo, but this includes much waste land due to excessive cutting, especially in the west. Three main areas are scientifically exploited: 1. Arisan—a chain of hills rising 2,800 to 8,700 feet, is for both conifers and hardwoods. A lumber line runs from Kagi, where there are saw-mills, into the forests. 2. The Hassenzan is a forested mountain lying east of Taichu and reached by a light railway. 3. The Dakusui Valley in Giran is a very rich area, but still infested by aborigine head-hunters.

Special interest attaches to the camphor trees of Formosa, and it is from this island that the bulk of Japan's output is obtained. The manufacture of camphor and camphor oil is under government license granted to a company; a government monopoly of the camphor industry was instituted in 1899 to prevent the rapid felling of trees. The huge expansion in the industry in recent years is due to the use of camphor in the celluloid industry.

The soil is exceedingly fertile, and vegetation is luxuriant. Agriculturally Formosa is important to Japan in two ways. Rice, the staple food, is grown in excess of local needs and hence there is a surplus available for export to Japan. In the second place tropical crops, notably sugar-cane, which can scarcely be grown in Japan proper, flourish in Formosa. The sweet potato is an important article of food for the natives and is also exported as material for alcohol. It can be cultivated all the year round. The Japanese have strenuously endeavored to put the sugar industry on a firm basis, but the island is far behind Java in such essentials as irrigation, systematic fallowing, yield, etc.

The fauna is related to that of Japan, and includes the deer, wild boar, poisonous snakes, bear, monkey, wild cat, civet, the domesticated water buffalo and 150 varieties of birds.



Mineral products are gold, silver, coal, copper, salt, sulphur and petroleum.

Industry and Trade.—The chief industry of Formosa is agriculture. Among the important products are camphor, which is under government control; tea, especially oolong; rice, sugar, sweet potatoes, ramie, jute and turmeric. Manufactures include flour, sugar, tobacco, oil, spirits, iron work, glass, bricks and soap.

Formosa was opened to foreign trade in 1858. The principal imports are fertilizers, cotton and silk textiles, iron and steel, timber and motor vehicles; exports include sugar, rice, bananas, tea and camphor oil. There are 622 miles of railway operated by the government and 1,516 miles operated by private companies.

Education.—There are a number of primary schools for the Japanese and natives; also normal schools, a medical school, an industrial school, a school for teaching the Japanese language to natives and *vice versa*, and a university (opened in 1928).

Peoples.—The population of Formosa in 1935 was 5,212,426, including 282,012 Japanese and 59,243 foreigners. The natives may be divided into Mongolians and aborigines. The origin of the Formosan aborigines is uncertain. They are well-built, wiry people, of medium stature; they are organized in numerous clans and tribes, differing in language, customs, and physical characteristics, and hostile to one another. A number of the tribes practice head hunting. Many of them have mingled with the Chinese, adopting their language and customs. The official language, however, is Japanese.

The ***Government*** is under the direct control of the Imperial Japanese Government, subject to which the governor-general has supreme authority. Administrative affairs and general judicial supervision are in the hands of a department of civil administration, at the head of which is a civil governor. There are military and naval staffs and a council for considering matters of legislation, finance, public works, etc. The principal towns are Taihoku (capital, pop. 274,157), Tainan, Kūrun and Taichu.

History.—Formosa is said to have been discovered by the Chinese at the beginning of the seventh century; the Portuguese visited it in 1590; and the Spanish occupied it early in the seventeenth century. The Spaniards were soon expelled by the Dutch, and they, in turn, were driven out in 1662 by Chen Kung, or Koxinga, a Chinese general, who set up a government of his own. After a reign of 23 years he surrendered the island to the Manchu emperors, who continued to rule it until 1895, when it was ceded to Japan by the Treaty of Shimonoseki, at the close of the Chino-Japanese War. Japanese civil government in Formosa began on March 31, 1896.

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Formosa, a territory of the Argentine Republic, adjoining the Republics of Bolivia and Paraguay. The land is low, and in

many places swampy. There are dense forests of valuable timber and stretches of excellent pasture land. Cattle are raised, and sugar cane, tobacco, vines, olives, bananas, cotton, rice, jute, hemp and ground nuts are produced. Area 29,143 square miles. Pop. 21,000.

Formosa (pop. 10,000), the capital, on the River Paraguay, is the only settlement of importance.

Formosa, Strait of, the channel which separates the island of Formosa from China, and connects the East China and South China Seas. Narrowest part, 90 miles wide.

Formo'sus, POPE (*c.* 816–896), was probably born in Rome, and was nominated bishop of Porto in 864. He was excommunicated and banished by John VIII., but was restored to his diocese by Marinus in 883. He was elected pope in 891. Stephen VI. denounced him as a usurper, and declared all his acts and measures void; but his pontificate was pronounced valid by a council presided over by John IX. in 898.

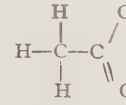
Forms of Action, in law. See ACTION.

Forms of Address. See ADDRESS, FORMS OF.

For'mula. In *Chemistry*, formulas express concisely the composition of compounds, and are of different kinds, according to the degree of explicitness with which the constitution is exhibited. The simplest, or *empirical formula*, expresses merely the proportions by weight in which the different elements are present. Thus, CH_2O, the empirical formula for acetic acid, signifies that this compound contains carbon, hydrogen, and oxygen in the proportions of 12, 2, and 16 parts by weight respectively; the symbols of the elements not only implying a particular element, but also a relative weight of it. Physical considerations, such as gas density, based on Avogadro's hypothesis, show, however, that acetic acid exists in molecules that are twice as heavy as those implied by the formula CH_2O; hence the empirical formula requires to be multiplied, in this case, by two to give the *molecular formula* $C_2H_4O_2$.

Molecular formulas can be given to gases, and to those solids and liquids that can be weighed as gases, or of which certain properties when in the state of solution can be measured; though it is possible, or indeed probable, that the molecular formula may be different in the state of gas or solution from what it is as a solid or pure liquid. In the case of non-volatile substances, or of substances of which the solutions mentioned above cannot be prepared, only the empirical formula can be given, though it is probable that the molecules of such substances are far more complex. Molecular formulas, subject to the above limitations, can also be given to free elements, and show the number of atoms to the molecule: as, oxygen is O_2; ozone, O_3; phosphorus, P_4.

A study of the chemical properties of a compound—that is, of the reactions it undergoes when treated in various ways—throws considerable light on its structure. Thus the molecule of acetic acid can be expressed by the *structural formula* $CH_3CO.OH$, which to the chemist exhibits not only the composition of acetic acid, but also gives an epitome of its chemical properties. These are called *linkage formulas* when the connections between the atoms are shown, and *valency formulas* when the links between the atoms obtained experimentally express a hypothesis. Structural formulas are often written *graphically* with the valency of each atom shown by lines or 'bonds'; but this method is cumbrous and reveals little more than the simpler method. Acetic acid written this way would be:



The difference between certain compounds known as 'stereoisomerides' cannot be exhibited by formulas on a plane, but requires *solid formulas* for its expression (see ISOMERISM).

A formula in which several elements can replace one another without affecting the crystalline form, etc., is used in mineralogy, the various elements being enclosed in parentheses, thus: $(K.H)_2(Mg.Fe)Al_2(SiO_4)_3$. This must not be confused with the common use of parentheses, to enclose groups of which several proportions are to be taken; thus, the K and H, and the Mg and Fe, are mutually replaceable, but not the Si and O. (See CHEMISTRY.)

In *Mathematics*, *Physics*, and *Engineering*, formula is the statement, by means of algebraic symbols, of a rule, principle, or phenomenon. Among innumerable examples are the formulas for finding the area of a circle ($r_2 \times 3.1416$) and the volume of a cone $\left(\frac{\text{area of base}}{3} \times \text{height}\right)$; Francis' formula for measuring the discharge of water over a weir; Descartes' formula for expressing the equation between the angles of incidence and refraction; Gordon's formula for calculating the strength of struts; Van der Waal's formula for expressing the relation of the volume of a gas to its pressure.

For'nax (CHEMICA), a small southern constellation formed by Lacaille in 1752. It lies in a bend of Eridanus, to the east of Sculptor.

For'ney, JOHN WEISS (1817–81), American journalist, was born in Lancaster, Pa. He became editor and joint proprietor of the Lancaster *Intelligencer*, and in 1840 gained control of the Lancaster *Journal*. In 1845 he was appointed deputy surveyor of the port of Philadelphia, and edited *The Pennsylvanian* from 1846 to 1851, when he was made clerk of the House of Representatives at Washington, and assumed the editorship of the Washington *Union*. He was Democratic candidate for U. S. Senator from Pennsylvania in 1857, and in the same year founded the Philadelphia *Press*. He joined the Republican Party; was re-appointed clerk of the House in 1859; and in 1860 established the Washington *Sunday Morning Chronicle*, which he afterward changed to a daily, and edited until 1870. From 1861 to 1868 he was secretary of the U. S. Senate; was a consistent supporter of Lincoln; and worked for Andrew Johnson's impeachment. In 1871 he was appointed collector of the port of Philadelphia. He published: *Letters from Europe* (1869); *Anecdotes of Public Men* (1873); *A Centennial Commissioner in Europe* (1876) *Forty Years of American Journalism* (1877).

For'res, town, Moray (Elgin) county, Scotland; 12 miles southwest of Elgin. Manufactures include woolens, boots, and chemical manure. Sweno's stone, an ancient obelisk, lies near. Pop. (1931) 4,169.

For'rest, EDWIN (1806–72), first great American actor, was born in Philadelphia of strong stock; his father being a Scotchman employed in Stephen Girard's bank, and his mother a superior German woman. The father dying penniless, Edwin left school for work at thirteen. He and a brother (many years a manager) were early stage devotees, and got up amateur theatricals. Edwin did bits in theatres from ten on; at fourteen, his first regular 'appearance,' he made a hit at the Walnut Street Theatre as Young Norval in Home's *Douglas*. But the East had too many trained actors to place a boy, and in 1822 he went West with a travelling company—Pittsburgh, Lexington (Ky.), Cincinnati. A typical 'barnstormer,' he was thrown adrift, wandered afoot, lived on stolen corn, played in barns, blacked as a minstrel, even joined a circus; in 1824 went to New Orleans. It was a hard but

effective training. He acted in the best—Shakespeare, Jonson, Otway, Georgian drama; saw and shared much violent, unshackled life; and lived a while with a Choctaw chief.

Returning at nineteen, Forrest took a man's post in Albany (1825–6), playing some time under Edmund Kean (q. v.), with lasting absorption of Kean's volcanic power. He was engaged for leading parts when the Bowery Theatre, New York, should open (November, 1826); and his first part, Othello, not only gained him an ovation, but began unapproached headship of the native American stage that lasted for forty years. It was legitimately earned by immense native power added to unflagging study, purposed observation, and intellectual analysis. But his giant might lacked grace and shading, and his art was uneven and too personal; he sorely needed traditional training. Less faultily, the natural expression of his Herculean person and spirit, and the stormy natures he embodied, was thought unnatural rant by those who understood only tameness. His greatest parts, says Lawrence Barrett, were such as Virginius, William Tell and Spartacus, of simple rugged force; the best Shakespearean, Lear, Othello and Coriolanus; his Richelieu was also noble.

An ardent patriot, Forrest resented the American stage being parasitic to the English; and mindful of his Choctaw friend, offered handsome prizes for native plays with aboriginal heroes. It was futile, but brought out the famous *Metamora,* still remembered by burlesqued tags. In 1836–7 he played at Drury Lane, London, with great success; was a social lion; and married the daughter of John Sinclair the singer. Their four children scarcely lived; and after a happy married life, a world-noted divorce suit parted them in 1850–2. A second English visit (1845–6) was a calamity. He was hissed from London; thought it Macready's work; and openly hissed the latter in revenge, thereby losing English good will. In 1848 Macready (q. v.) came to America; Forrest's New York partisans broke up the closing performance in 1849. (See Astor Place Riot). From 1853 to 1860 Forrest retired; in 1865 he was partially paralyzed, and never recovered; and a new world of dramatic fashions and actors left him a survival, though he kept the stage till 1872.

Forrest was an irritable, unforgiving man, but deeply loving, grateful, tender hearted, and extremely generous; and his word was sacred. He left a large fortune, most of it to found the Edwin Forrest Home for aged and destitute actors near Philadelphia (incorporated 1873); but claims on the money and provisions in the will made this institution much of a failure. Consult *Lives* by Rees, Alger (the chief), and Barrett.

Forrest, Sir John (1847–1918), Australian explorer and statesman, born near Bunbury, Western Australia. He entered the survey department of the colony (1865); commanded an expedition into the interior of Australia in search of Dr. Leichhardt (q. v.) and his party (1869); and headed exploring expeditions from Perth to Adelaide (1870), and from Champion Bay to a point on the telegraph line from Adelaide to Port Darwin (1874). In 1876–82 he was engaged in government survey work, and in 1883–1900 was commissioner of crown lands. When responsible government was granted to Western Australia he became first Premier and treasurer (1890–1901); and was later postmaster-general (1901), minister of defense (1901–03), and minister of home affairs (1903–04). He served as acting Prime Minister of the Commonwealth (March to June, 1907), and three times as treasurer (1905–07, 1909–10, 1913–14). He was knighted in 1891. His publications include: *Explorations in Australia* (1876); *Notes on Western Australia* (1884–7).

Forrest, Nathan Bedford (1821–77), American soldier, a distinguished Confederate cavalry commander during the Civil War, was born near Chapel Hill, Tenn. His father was a blacksmith, who removed to Tippah county, Miss., in 1834, where the son received a rudimentary school education, covering at most a period of six months. Becoming a slave trader and real estate dealer at Memphis, Tenn., he had amassed considerable wealth by 1859, and then returned to Mississippi, where he was a cotton planter. In June, 1861, he joined the Confederate army, and raised a battalion of cavalry, of which he became lieutenant-colonel. He took a conspicuous part in the defense of Fort Donelson; and after its capitulation had been decided on, escaped during the night of Feb. 15, 1862, at the head of about 1,500 men (see Donelson, Fort). He then participated in the Battle of Shiloh; was raised to the rank of brigadier-general in July, 1862; served under Bragg in Kentucky, and then in Northern Mississippi; was promoted major-general in December, 1863; was placed in command of the cavalry of the Army of the Tennessee in November, 1864, where he was conspicuous in the battles of Franklin and Nashville; and was promoted lieutenant-general in February, 1865. He was defeated by Gen. J. H. Wilson at Selma, Ala., in March, 1865; and surrendered his troops at Gainesville, Fla., in May.

In the course of the war Forrest made many raids, fought innumerable skirmishes, and proved himself one of the most daring, resourceful, and skilful cavalry leaders on either side. One of his exploits was the capture, with only about 500 men, of the command of Colonel Streight, of about 1,600 men (May 2, 1863). Forrest constantly harassed Sherman during his campaigns in the West, and in his March to the Sea; and after the war Sherman pronounced him 'the most remarkable man our Civil War produced on either side.' In the North he was generally blamed for the so-called 'Fort Pillow massacre' (April 12, 1864), in the accounts of which there is a wide divergence, and for which he always denied responsibility (see Pillow, Fort).

After the Civil War, Forrest returned to his plantations for a time; engaged in an unsuccessful project for a railroad between Memphis and Selma; and is said to have been the guiding spirit of the Ku-klux Klan (q. v.). Consult Jordan and Pryor, *Campaigns of N. B. Forrest;* Wyeth, *Life;* Mathes, *General Forrest* (in 'Great Commanders Series').

Forssell, fôrs-sel', Hans Ludvig (1843–1901), Swedish historian, was born in Gefle. In 1866 he became reader in history at Uppsala; and in 1875 he was appointed minister of finance. He was also editor of the *Svensk Tidskrift,* and a member of the Swedish Academy. His chief works are: *Sveriges Inre Historia från Gustaf I* (1869–75); *Studier och Kritiker* (1875–88); *Gustaf II Adolf* (1894).

Förster, für'ster, Ernst Joachim (1800–85), German painter and author, brother of Friedrich Förster (q. v.), was born near Kamburg, on the Saale. In association with Cornelius he prepared some very fine frescoes in Bonn and Munich. Traveling in Italy, he not only gathered materials for his great work, *Beiträge zur Neuern Kunstgeschichte* (1836), but was the means of discovering some long-hidden frescoes in the Chapel of St. George at Padua. He then largely relinquished the practice

of art, and became its historian and literary exponent. His chief works are: *Geschichte der Deutschen Kunst* (5 vols., 1851–60); *Denkmale Deutscher Baukunst, Bildnerei und Malerei* (12 vols., 1853–69); *Geschichte der Italienischen Kunst* (5 vols., 1869–78); *Denkmale Italienischer Malerei* (4 vols., 1870–82). He also wrote biographies of *J. G. Müller* (1851), *Fra Angelico* (1859), *Raphael* (1867–9), and *Cornelius* (1874); translated, with Schorn, Vasari's *Lives of the Painters* (1843–9); and edited the posthumous works (1836–8) of his father-in-law, Jean Paul Richter, whose *Life* (1849) he also wrote.

Förster, Friedrich Christoph (1791–1868), German historian, brother of Ernst J. Förster (q. v.), was born near Kamburg, on the Saale. For a time he was professor of military engineering in Berlin, but lost his chair owing to his liberal views on politics. After traveling in Italy he was appointed (1829) chief custodian of the Royal Museum at Berlin, and held the position until his death. His chief works are: *Der Feldmarschall Blücher und seine Umgebungen* (1821); *Friedrich der Grosse, Jugendjahre, Bildung und Geist* (1822), to which Carlyle owed much; *Albrecht von Wallenstein* (1834); *Geschichte Friedrich Wilhelms I* (1835); *Die Höfe und Kabinette Europas im 18 Jahrhundert* (1836–39). He also wrote popular historical works on Prussia, edited an edition of Hegel, and wrote several poems and dramas.

For'ster, Johann Georg Adam (1754–94), German naturalist, was born at Nassenhuben (Danzig). When only seventeen years of age he accompanied his father, J. R. Forster (q. v.), in Captain Cook's second voyage (1772), and published, with the assistance of his father, an account of the expedition. He was for a time in Paris, and there made the acquaintance of Buffon and Franklin. He was successively professor of natural history at Kassel (1778–84) and at Vilna 1784–7), and librarian (1788) to the elector of Mainz. He also wrote: *Ansichten vom Niederrhein von Brabant, Flanders, Holland, England, und Frankreich* (1791–4), and *Kleine Schriften* (6 vols. 1789–97).

Forster, Johann Reinhold (1729–98), German naturalist and traveler, was born in Dirschau, Prussia. Migrating to England (1766), he first held an appointment as teacher of modern languages and science at Warrington. He then accompanied Captain Cook in his second voyage (1772) as naturalist and scientific observer. On his return he published in collaboration with his son, J. G. A. Forster (q. v.), *Observations Made During a Voyage Round the World* (1778). He was then selected as professor of natural history at Halle (1780), where he remained until his death. He also wrote a work on *Mineralogy* (1768); *Flora Americæ Septentrionalis* (1771); *Geschichte der Entdeckungen und Schiffahrten im Norden* (1784).

Forster, John (1812–76), English biographer, essayist, and historian, was born in Newcastle. He was educated for the bar, but early devoted himself to periodical writing. In 1833 he was appointed literary and dramatic critic for *The Examiner*. He published the first of five volumes on the 'Statesmen of the Commonwealth' in 1836, and the last two, containing a 'Life of Cromwell,' in 1839. He wrote for *The Edinburgh Review* in 1845; succeeded Dickens as editor of *The Daily News* in 1846; and edited *The Examiner* from 1847 to 1856. He was the author of many admirable biographical and historical essays, besides the following works: *The Life and Adventures of Oliver Goldsmith* (1848; new ed. 1854); *Arrest of the Five Members* (1860); *Debates on the Grand Remonstrance* (1860); edited Landor's *Imaginary Conversations* (1864), and published a *Life of Landor* 2 vols., 1869); and wrote the valuable *Life of Dickens* (3 vols., 1872–4). He left an unfinished *Life of Swift* (vol. i., 1876). Consult R. Renton, *John Forster and His Friendships* (1913).

Forster, John Wycliffe Lowes, Canadian artist, was born in Norval, Ontario, and studied art in Paris under Bouguereau, Fleury, and Carolus Duran. He is represented in many Canadian public buildings by historic portraits, and received numerous awards from expositions. He became a member of the Royal Canadian Academy. Among his subject pictures may be mentioned: *Gossips; The Old Story; Rival Schools; In-as-much; Hiawatha's Vision; The Colonial Conference, Ottawa; Departure of Canada's First Contingent; Kismet; Iman; Eventide; Lundy's Lane.*

Forster, William Edward (1818–86), English statesman, born at Bradpole, Dorsetshire, the son of William Forster, a Quaker missionary. From 1861 until his death he represented Bradford in the British Parliament, and was one of the advanced Liberal leaders. During the American Civil War he opposed all attempts to recognize the Confederate States, and denounced Great Britain's action in permitting Confederate war vessels to be built in British shipyards. After serving as undersecretary for the colonies (1865–6), he became in 1868 vice-president of the council on education, and a privy councillor. He entered the Gladstone Cabinet in 1870, and the same year introduced the greatest legislative measure associated with his name, the Elementary Education Bill. In 1872 he conducted the Ballot Bill through the House of Commons. After the resignation of the Liberal ministry in 1874 he visited the United States, where he received an enthusiastic welcome. He counted among his personal friends Emerson, Adams, and Sumner.

In the Gladstone administration of 1880 Forster accepted the office of chief secretary for Ireland. An agrarian and political agitation was then disturbing a large portion of Ireland. Forster was attacked unceasingly in Parliament by the Irish members, and his life was threatened by the 'Invincibles.' (See Ireland, *History.*) In April 1882 he resigned. He took a profound interest in the Imperial Federation Scheme, being anxious to strengthen the bonds between Great Britain and her colonies. In character, Forster was loyal, honest, unselfish, and courageous. He was an effective Parliamentary speaker, though he had none of the shining gifts of oratory.

Forsyth, fôr-sīth', city, Georgia, county seat of Monroe county, on the Central Railroad of Georgia; 75 miles S.E. of Atlanta. It is the seat of Bessie Tift College. Cotton is manufactured. Pop. (1920) 2,241; (1930) 2,277.

Forsyth, George Alexander (1837–1915), American soldier, was born in Muncy, Pa. He fought during the entire Civil War in the Army of the Potomac, taking part in sixteen battles, two sieges, and over sixty minor engagements, and being wounded four times. At its close he was mustered out with the rank of major of volunteers. He then entered the regular army (1866), becoming a major in the Ninth Cavalry. For twenty-four years, until his retirement in 1890, he was on staff and frontier duty. One of his most thrilling exploits was at the Battle of Arickaree Fork (September, 1867), when with 50 men he held off a force of 700 Cheyenne warriors for nine days, till relief arrived. For this ex-

ploit he was brevetted brigadier-general. He served as military secretary (1869–73), and later as aide-de-camp (1878–81), to Gen. Philip Sheridan. In 1875–6 he was a member of the special board of officers appointed to inspect the armies of Europe and Asia. He wrote: *Thrilling Days in Army Life* (1900); *The Story of the Soldier* (1900).

Forsyth, James William (1836–1906), American soldier, was born in Ohio. He was graduated from West Point (1856), and received a captain's commission in October, 1861. He served in the Peninsular and Maryland campaigns in the Civil War, and was brevetted major for gallantry at Chickamauga (1863), lieutenant-colonel for services in the Battle of Cedar Creek (1864), and colonel for services at Five Forks (1865). He was assistant adjutant-general of volunteers and chief of staff to Major-General Sheridan (1864–5), attaining the rank of brigadier-general of volunteers and brevet of the same rank in the regular service. He became colonel of the Seventh Cavalry in 1886, and brigadier-general in 1894, and was retired with the rank of major-general in 1897.

Forsyth, John (1780–1841), American public official, was born in Fredericksburg, Va., He was graduated from Princeton (1799), and was admitted to the bar at Augusta, Ga., in 1802. He became attorney-general of the State in 1808, member of Congress in 1813, and U. S. Senator in 1818. In 1819–22 he was minister to Spain, and negotiated the treaty whereby Florida was ceded to the United States. He was again a member of Congress in 1823–7, and was an active champion of the governor of Georgia in his dispute with the National Government over the removal from that State of the Creek and Cherokee Indians. In 1827 he was elected governor of Georgia, and in 1829 was again sent to the U. S. Senate, where he denounced the nullification measures of South Carolina. He supported Clay's Compromise Act of 1833, and President Jackson's war upon the U. S. Bank in 1834. He was made Secretary of State by Jackson (1834), and retained that office through Van Buren's administration (1837–41).

Forsyth, Sir Thomas Douglas (1827–86), Anglo-Indian civilian, was born in Birkenhead. He entered the East India Company's service in 1848, and distinguished himself at Umballa during the Mutiny (1857), and as special commissioner at Delhi. In 1860–72 he was commissioner of the Punjab, where he did much to stimulate trade with Turkestan, and settled the long-standing territorial dispute between Russia and the Emir of Kabul. He led (1871 and 1874) two expeditions to Eastern (Chinese) Turkestan, and concluded a treaty with Yakub Beg, the ruler of that region. His *Mission to Yarkand* (1871) and *Report of a Mission to Yarkand* (1875) are of great value. His *Autobiography* was published in 1887.

Forsyth, William (1812–99), British author, was born in Greenock, Scotland. He was called to the English bar (1839); became Queen's Counsel (1857); and represented Marylebone in Parliament in 1874–80. He was editor of the *Annual Register* (1842–68), and wrote: *Hortensius* (1849); *History of the Captivity of Napoleon at St. Helena* (1853); *Life of Cicero* (1863); *Novels and Novelists of the Eighteenth Century* (1871); *Essays, Critical and Narrative* (1874).

Forsythia, for-sī'thi-*a or* -sith'-i-*a*, a genus of hardy, deciduous shrubs of the order Oleaceæ. The flowers are yellow, single, and drooping. The best-known species is *F. suspensa* from China, which grows to a height of seven or eight feet.

Fort. See Fortification; Forts.

Fort, John Franklin (1852–1920), American jurist and public official, was born in Pemberton, N. J. He was graduated from Pennington Seminary (1869) and from the Albany Law School (1872), and was admitted to the bar of New Jersey in 1873. He was judge of the district court in Newark, N. J. (1879–86); presiding judge of the Essex county court of common pleas (1896–1900); and justice of the supreme court of New Jersey (1900–07). From 1908 to 1911 he was governor of New Jersey. He acted as the representative of the President of the United States in the reconstitution of the government of Santo Domingo in 1914, and of Haiti in 1915.

Fort Adams, situated on Brenton's Point, at the entrance to Newport Harbor, R. I., was the site of a fort during the American Revolution. It is now a U. S. military post. See Forts.

Fortaleza, fôr-tä-lā'zä, or Ceará, city and port of Brazil, capital of the state of Ceará; 7 miles northwest of the mouth of the Ceará River. It is a bishop's see. It has broad, well-paved streets, and is attractively laid out. The principal buildings are the government house, legislative chambers, and bishop's palace. Sugar, coffee, rubber, cotton, rum, fruits, and hides are exported. Pop. (1937) 146,852.

Fort Andrews, a U. S. military post, one of the defenses of Boston Harbor. See Forts.

Fort Ann, village and summer resort, New York, Washington county, on the New York State Barge Canal and the Delaware and Hudson Railroad; 67 miles north of Troy. Pop. (1930) 389.

A fortified camp was established at this point in 1690 by Fitz John Winthrop (q. v.) Colonel Nicholson erected a fort on the site in 1709, which was rebuilt in 1797 as Fort Ann. It was the scene of a battle in the French and Indian War, and was occupied and partially destroyed by the British in the American Revolution.

Fort Atkinson, city, Wisconsin, Jefferson county, on Rock River and the Chicago and North Western Railroad; 55 miles s.w. of Milwaukee. The manufactures include dairy and pasteurizing apparatus, farm equipment for buildings, hosiery, powdered milk and electrical fixtures. General Atkinson built a fort here in 1836 during the Black Hawk War. Pop. (1920) 4,915; (1930) 5,793.

Fort Baker. See Forts.

Fort Banks. See Forts.

Fort Barrancas. See Forts.

Fort Barry. See Forts.

Fort Bayard, bī'ard (alt. 6,040 feet), military reservation, Grant county, New Mexico; 8 miles n.e. of Silver City. Bayard Station is 3 miles distant. It is the seat of a U. S. Government sanitarium for the treatment of cases of pulmonary tuberculosis.

Fort Beaufort, bō'furt, district, Cape Colony, famed for its wool, mohair, and tobacco. Pop. 25,000.

Fort Bliss. See Forts.

Fort Bow'yer, formerly a fort on Mobile Point, at the entrance to Mobile Bay. It was built in 1813 by General Wilkinson, and with a garrison of 160 men under Major William Lawrence successfully resisted the British forces under Captain Percy in September, 1814. It fell on Feb. 11, 1815, after the Battle of New Orleans.

Fort Brady. See Forts.

Fort Bragg. See Forts.

Fort Casey. See Forts.

Fort Chippewyan, chip-*e*-wī'*an*, situated opposite the mouth of the Athabasca River, at the southwest end of the lake of the same name, is a training post of the Hudson's Bay Company (q. v.), and an orphan mission station.

Fort Churchill, trading station of the Hudson's Bay Company (q. v.), at the mouth of the Churchill River, where it enters Hudson Bay.

Fort Clark, a U. S. military post on Las Moras Creek, near Brackettville, Tex. It helps guard the San Antonio and Eagle Pass road and the Mexican border. See FORTS.

Fort Collins, city, Colorado, county seat of Larimer county, on Cache la Poudre River, and the Union Pacific and the Colorado and Southern Railroads; 65 miles north of Denver. It is the seat of the State Agricultural College, and the headquarters of the Colorado National Forest. The city is one of the main gateways to Estes Park and Poudre Cañon; it is the center of a rich agricultural and stock-raising region. The chief products are beet sugar, alfalfa, flour, brick, and tile. The Council-Manager form of government was adopted March 1, 1939. Pop. (1930) 11,489; (1940) 12,183.

Fort Constitution. See FORTS.

Fort Dauphin, fôr dō-faṅ', one of the earliest French settlements in Madagascar (q. v.), on the southeast coast.

Fort Davis. See FORTS.

Fort Dearborn. See DEARBORN, FORT.

Fort de France, fôr *de* fräṅs' (formerly FORT ROYAL), fortified town and capital of Martinique, on the west coast. It has a good harbor, a law school, a naval arsenal, and a prison. The governor-general of the French West Indies resides here. Pop. 52,051.

Fort Des Moines. See FORTS.

Fort Dix, formerly (until March 1, 1939) named Camp Dix, a military reservation of more than 3,000 acres, 20 miles S.E. of Trenton, N. J. The camp was established in 1917 for the training of World War soldiers, and since used for the summer training of army regulars, reserve officers and C.M.T.C. members, and for the enrollment and discharge of CCC workers.

Fort Dodge, city, Iowa, county seat of Webster county, on the Des Moines River and the Illinois Central, the Chicago Great Western, and the Minneapolis and St. Louis Railroads, and on a local electric line; 87 miles N.W. of Des Moines. It has Y. W. C. A. and Y. M. C. A. buildings, a large public library, hospital, three parochial schools, a high school, a junior high school, a municipal building, four city parks, and a tourists' camping ground.

Important manufactures are gypsum and clay products, job printing, oatmeal and corn products, foundry products, tents and awnings, clothing, ice cream and dairy products, confectionary, carbonated drinks, road markers, butter tubs, bread, florists' products, and has serum plant and a modern packing plant. Fort Dodge is an important jobbing center and a pork and grain buying market. Coal, glass sand, gypsum, clay, and building stone are found in the vicinity. Commission government was adopted in 1911. Fort Dodge was first settled in 1850. It was one of the early posts of the State, and the terminous of the northern stage line from Des Moines. Pop. (1940) 22,875.

Fort Donelson. See DONELSON, FORT.

Fort Douglas. See FORTS.

Fort Du Pont. See FORTS.

Fort Duquesne. See DUQUESNE, FORT.

Fort Edward, village, New York, Washington county, on the Hudson River, the New York State Barge Canal and the Delaware and Hudson Railroad; 50 miles north of Albany. It has paper and pulp mills, three shirt factories, and a pottery plant. It was incorporated in 1849. Pop. (1920) 3,871; (1930) 3,850.

The present village was founded on the site of a fort built by Gen. Phineas Lyman in 1755, and first known as Fort Lyman, but afterward named Fort Edward, in honor of one of the grandsons of George II. The fort was important during the French and Indian War as a starting point of expeditions against the French, and the refugees from Fort William Henry fled there after the massacre of 1757. It was the headquarters of Gen. Philip Schuyler during part of the campaign against Burgoyne in the American Revolution; but was later abandoned by the Americans and fell into the hands of the British. Jane McCrea (q. v.) was killed here by the Indians.

Fort Erie, town, Ontario, Canada, Welland county, at the junction of Lake Erie and the Niagara River, opposite Buffalo, N. Y., on the Canadian National, the Canadian Pacific, and the Michigan Central Railroads. Pop. (1921) 1,546; (1931) 6,600.

The town is situated on the site of Fort Erie, which was the scene of severe fighting during the War of 1812. It was captured by an American force of 170 men under Gen. Jacob Brown (q. v.) on July 3, 1813; and in 1814, after the Battle of Lundy's Lane, it was occupied by 2,000 American troops, who completed the fortifications. The fort was bombarded by the British from Aug 7. to Aug. 14, 1814, and a few months later was blown up by the Americans; it was never rebuilt.

Fortescue, fôr'tes-kū, CHICHESTER SAMUEL, afterward PARKINSON, BARON CARLINGFORD, and BARON CLERMONT (1823–98), British statesman. An advanced Liberal, he held minor offices under Lords Aberdeen and Palmerston, and under Lord John Russell became Chief Secretary for Ireland (1865), an office he continued to hold in Gladstone's first administration (1868).

Fortescue, SIR JOHN (*c.* 1531–1607), English statesman, was classical tutor to Princess (afterwards Queen) Elizabeth while Mary occupied the throne, and when Elizabeth became queen he was appointed to a court position. He became a member of Parliament in 1572, and in 1589 was appointed chancellor of the exchequer, and later chancellor of the duchy of Lancaster in 1601. An official of the Star Chamber (q. v.), he sat on various commissions and introduced the queen's financial needs in parliament. Elizabeth's successor, King James, deprived him of the office of chancellor of the exchequer, but permitted him to retain his other offices. At an election in 1604 he was a candidate for Buckinghamshire, and was defeated. The winner, however, was unseated on legal grounds, and Fortescue was returned on a second election. The decision of the unseating had been made by the Lord Chancellor, and a strong opposition in parliament questioned his right to decide disputed elections. The House of Commons rejected this theory, but the king upheld it. A long debate ensued, and the matter was finally settled by a compromise which left the question open. Both candidates were excluded and a new writ was issued. The political career of Fortescue was ended. He was a friend of Sir Thomas Bodley, founder of the Bodleian Library at Oxford.

Fortescue, SIR JOHN (*c.* 1394–*c.* 1476), English judge, was born in Somersetshire, and became (1442) lord chief justice of England in the reign of Henry VI. He accompanied Margaret of Anjou and her young son, Prince Edward, on their flight into Scotland, and in 1463 he embarked with the Queen and her son for Holland. During his exile he wrote his celebrated work, *De Laudibus Legum Angliæ* (printed 1537). It is a eulogy on the laws of England, written in the form of a dialogue between himself and Prince Edward. He obtained a

pardon in 1471, and returned to England. His *Governance of England*, written in English, was not published till 1714.

Fort Ethan Allen. See FORTS.

Fort Fairfield, town, Aroostook county, Maine, on the Aroostook River, and the Bangor and Aroostook and the Canadian Pacific Railroads; 140 miles north of Bangor, on the New Brunswick border. It is the site of an old fort. The surrounding country produces large quantities of potatoes. Pop. (1920) 1,993; (1930) 2,616.

Fort Fisher. See FISHER, FORT.

Fort Flagler. See FORTS.

Fort Frontenac. See FRONTENAC, FORT.

Fort George. See GEORGE, FORT.

Fort Gibbon. See FORTS.

Fort Greble. See FORTS.

Fort Griswold. See GROTON.

Forth, river and estuary of Eastern Scotland. The river is formed by two head streams—Duchray Water and Avondhu—both rising on Ben Lomond in Stirlingshire, and uniting, after courses of 12 and 10 miles respectively, near Aberfoyle. From there the Forth winds through the Central Lowlands for 39 miles to Stirling, below which it follows a still more tortuous course (the Links of Forth) for 12 miles to Alloa. The *Firth of Forth,* as the estuary is known, extends from Alloa to the North Sea, a distance of 51 miles, between Clackmannanshire and Fifeshire on the north, and Stirlingshire and the Lothians on the south. Opposite Borrowstounness it expands to two and one-half miles, but contracts to about a mile at Queensferry, where it is spanned by a great cantilever bridge, the Forth Bridge (see BRIDGE). From that point it gradually widens to 18 miles at its mouth. The depth varies from 3 to 37 fathoms. Vessels of 300 tons can ascend to Alloa, and vessels of 100 tons to Stirling.

The territory drained by the Forth covers 645 square miles. The principal tributaries of the river are the Teith, Allan Water, and Devon. The Carron, Avon, Almond, Leith, Esk, and Tyne empty into the Firth from the south, and the Tiel, Leven, Kiel, and Dreel from the north. Salmon and whitefish abound in river and firth, and fishing villages and holiday resorts are numerous along both shores. The scenery is picturesque and rich in historical interest. Above Queensferry, on the Fifeshire coast, is the sheltered bay of St. Margaret's Hope and the British naval base of Rosyth.

Fort Hamilton, a U. S. military post, one of the defences of the southern entrance to New York Harbor, is situated on the southwestern end of Long Island, opposite Fort Wadsworth (q. v.), at the Narrows. See FORTS.

Fort Hancock, U. S. military post, situated at the extremity of Sandy Hook (q. v.), N. J., commands the seaward approaches to Lower New York Bay. See FORTS.

Fort Henry. See DONELSON, FORT.

Fort H. G. Wright. See FORTS.

Fort Howard. See FORTS.

Fortification, in military engineering, is the art of strengthening military positions against attack. It involves the two elements of *protection* and *obstacles.* By the first, the defenders are shielded from their opponents' fire; by the second the attackers are delayed under the fire of the defenders, or are prevented from coming to close physical contact with them. Protection may be given by a wall or earthen parapet thick enough to keep out projectiles, by concealment, or by advanced works constructed well out in front of the main position. Obstacles may be wet or dry ditches, or some form of entanglement or palisade.

The design of any fortification is determined by many considerations, as the nature of the ground, the materials available for construction, the weapons in use, and the strategic possibilities of the site. But whatever the design finally adopted, it should be simple, and the two elements of protection and obstacles should be so combined as to give the most efficient results. The character of the protection will usually depend upon the weapons in use by a possible attacker; but the obstacles must be so placed as to be under fire by the defenders, and at the same time allow full scope for counter-offensive by the defence.

Fortification is properly divided into two branches, Permanent Fortification and Field Fortification. *Permanent fortifications* are works constructed at leisure, generally in time of peace and of enduring materials, for the defence of positions of permanent importance, as arsenals, dockyards, commercial harbors, large railway centres, and important points on the frontiers of a state. *Field fortifications* are works extemporized by troops in the field, of materials found on the site, and they are constructed for a temporary purpose only. As a rule, they lose their military value at the end of the war; but they may be strengthened after the first hasty construction, and gradually approach permanent fortifications in the character of the materials used and the protection afforded.

A third class of fortifications sometimes referred to has characteristics of both preceding classes, and is generally known as semi-permanent. These are works hastily constructed in time of need, but with ample resources of materials and civilian labor available.

Permanent Fortifications. — As the application of field fortification is comparatively recent, the history of fortification is mainly that of permanent fortification. The origin of such works antedates authentic history, their general character varying from age to age in accordance with the means employed in the attack and defence of fortified towns. For convenience their history may be divided into four periods.

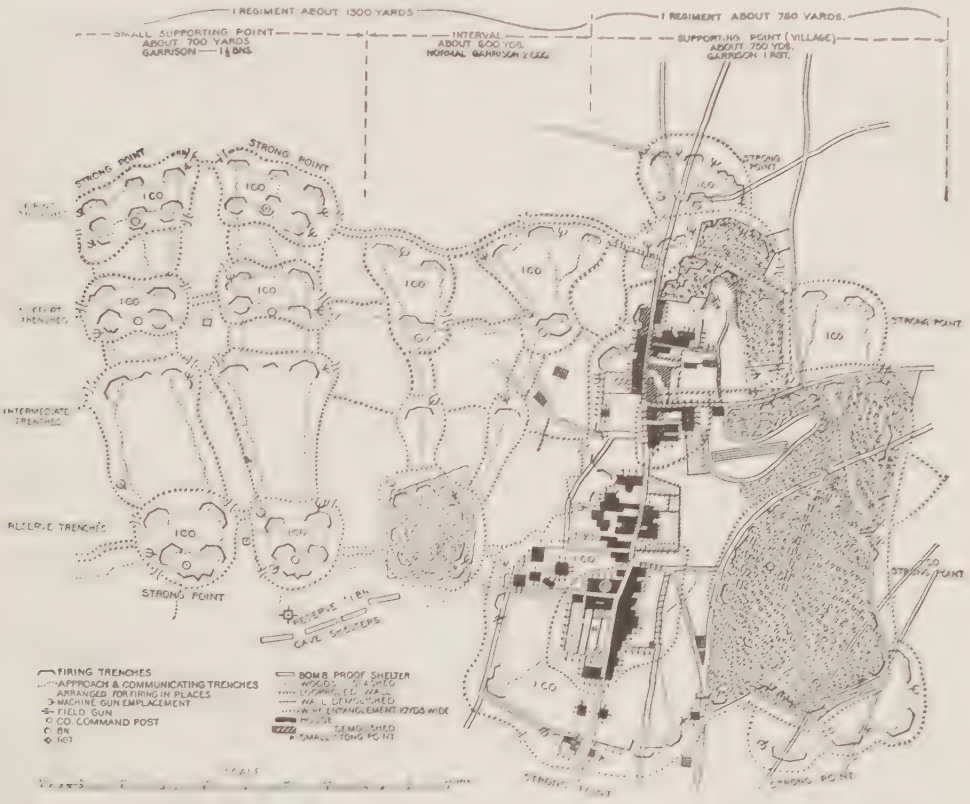
1. From earliest time to the employment of cannon, about 1500 A.D. During this period there was little recorded change in the arms or methods of attack and defence of fortified places. The small missile weapons were spears, bows and arrows, and slings; the large missile weapons were the catapult and ballista (qq.v), throwing heavy arrows and stones; and the besieging engines were battering rams, movable towers, and scaling ladders. To resist such engines, the type of fortification adopted was a thick stone wall with towers at intervals along its length and at the corners, and a path or boulevard along the top on which the defenders stood to repel assaults. A light stone wall or battlement protected this boulevard, and served to shelter the defenders from hostile fire and partially conceal them from view of the assailants. Walls of this character often enclosed an entire city or a large tract of country.

The assailant endeavored to capture the fortification through breaching the wall by battering and undermining, or through driving the defenders from the battlements by means of movable towers, and scaling.

2. From 1500 to 1815 A.D. The invention of gunpowder did not at first greatly affect the existing type of fortification, as the early cannon, in use for many years, fired stone balls, and were but little more effective than the old engines they replaced. The invention of cast-iron shot, however, about 1480, did away with the overwhelming superiority possessed up to that time by the defence over the attack; and in the Italian campaigns of Charles VIII. of France (1494), fortified places fell rapidly before his large and powerful artillery. The disintegrating effect of the new projectile on stone soon led to the use of earth as a front covering to the masonry. Parapets were made much thicker by the addition of earth inside the walls, to furnish greater protection and to

Fortification

give a greater width at the top of the wall for the heavy artillery, now necessary to keep the breaching batteries of the besiegers at a distance; and by degrees the height of the parapets was reduced to a command of thirty feet or less. The high, steep wall having been abolished, some other obstacle to the advance of the assailant became necessary. This was provided by a wet or dry ditch, twenty or more feet in width and of varying depth. The



Fortification.—I. Plan of entrenchments for the defence of a position by two regiments of infantry.

exterior wall of the parapet now served as the interior retaining wall of the ditch, or *scarp wall.* The exterior wall of the ditch, or *counterscarp,* was also revetted with masonry. No more than one-third of the parapet was exposed above the surface of the ground, and this was further protected and concealed from distant view by a mound of earth, called the *glacis,* thrown up just outside the ditch. The parapet, thus concealed, could be breached only by guns established on the glacis itself and within two hundred yards of the wall. The bottom of the ditch was defended by fire from subterranean galleries constructed inside the scarp and counterscarp walls.

The necessity of securing greater defensive fire and of bringing fire to bear on the ditch led to modifications of the trace or ground plan of the works, and there resulted two systems of fortification—the *bastioned,* which accomplished the sweeping of the ditches by fire from adjoining faces of the work itself, and the *polygonal,* which secured this fire by means of *caponiers,* or small galleries, constructed across the ditch in the centre of each face. The Latin nations of Europe generally adopted the bastioned system during this period, while near its close the Germanic nations adopted the polygonal system.

Of the two systems, the bastioned was the earlier, reaching its highest development under Marshal Vauban (q. v.), the great French military engineer of the time of Louis XIV. The polygonal system was introduced during the eighteenth century, and had for its greatest exponent the Marquis de Montalembert.

In the bastioned trace, if the enemy's artillery attacked the curtain, it was met by a direct fire from the curtain itself and by a cross fire from the adjacent faces of the bastions. The weak points were the salient angles of the bastions, as no cross fire could be brought to bear to cover the ground in front of these. To remedy this weakness, minor works of lower command, called *ravelins,* were built outside the ditch and in front of the curtains. In time other minor works were added outside the main walls; thus a step-by-step defence could be adopted by which the garrison retired from line to line as they were driven from one minor work to the next work toward the interior of the fortress, thereby enabling the defence to be much prolonged. In this way the trace of a seventeenth and eighteenth century fortress became a species of geometrical puzzle with its retrenchments, cavaliers, hornworks, tenaillons, demi-tenaillons caponiers, ravelins, bastions, and other parts. Elaborate permanent fortification design reached its highest development during this period. Among the more fa-

Fortification

mous military engineers of the period were the Italians Castriotto and Paciotto; the Dutchmen Speckle, Count Maurice of Nassau, and Coehoorn; and the Frenchmen Bar-le-Duc, De Ville, De Pagan, Vauban, Cormontaigne, Montalembert, Carnot, and Chasseloup-Laubat.

3. From 1815 to 1871 A.D. To the end of the Napoleonic Wars, every fortress had been surrounded by a continuous line of fortification, or *enceinte*. During the latter part of the preceding period the tendency had been to strengthen the advanced works in front of the enceinte, and to make of them small detached forts. When the peace of 1815 gave European engineers an opportunity of profiting by their war experiences, the art of fortification underwent a radical change. The range of artillery had been increasing steadily, until, at the beginning of the nineteenth century, breaching could be carried out effectively at distances up to about eight hundred yards. In order to keep the guns of the besiegers far enough away to prevent breaching, a girdle of detached forts was constructed about a mile in advance of the enceinte, and at such intervals as to allow of mutual support with flanking fire. Each fort was garrisoned, provisioned, and armed to stand a separate siege. The bastioned trace was extensively employed for these works. The Germans, however, in the reconstruction of their fortresses during this period, adopted the polygonal system, with a line of small but strong detached forts one-half mile or more in advance of the main enceinte.

4. Since 1871. In 1859 rifled artillery was used extensively for the first time in a great war—that between France and Austria. During the next ten years the effective breaching range of siege guns was increased to four thousand yards. But few changes were made in existing fortifications until after the operations of the Franco-Prussian War had shown that existing forts could not withstand the attack of an enemy equipped with the then modern artillery. The Siege of Paris particularly illustrated the uselessness of existing designs. The detached forts were not far enough out to protect Paris from bombardment, and their commanding ramparts made conspicuous targets for the German gunners. Inside were crowded garrison, guns, magazines, and stores; a shell scarce could fail to hit one of them, and the detached fort became in fact a shell trap. As a result, the armament was taken out and placed in the intervals in batteries or in single emplacements, and the forts became simpler in design.

The effective range of guns grew so fast that with each decade, in order to preclude all risk of bombardment, it was necessary to push out farther the girdle of forts.

The effective range of guns and rifles no longer advertises their presence to the enemy by a cloud of smoke, concealment has become an essential factor in the design of all works.

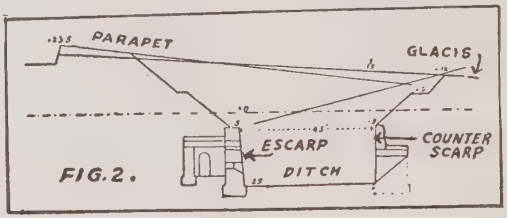


FIG. 2.

FIG. 3.

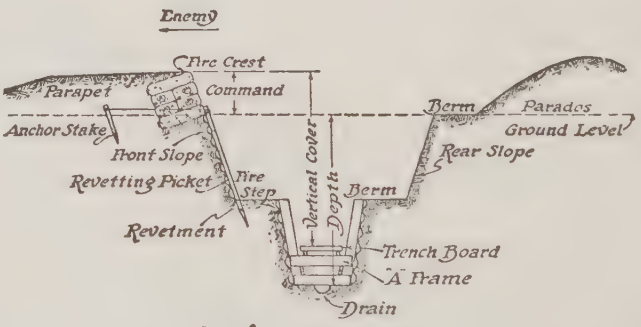


FIG. 4.—Trench nomenclature.

Fig. 2. Section through the parapet and ditch of an old-type permanent work. Fig. 3. The bastion trace applied to a square fort.

The general trend of fortification design since the introduction of rifled guns has been toward the reduction of the large detached forts to the smallest possible infantry strong points or centres of resistance, the improvement of cover and concealment for the guns and concrete bomb-proofs for the troops, the abandonment of deep ditches as obstacles to assault, and the reduction of command. The last point was given additional importance by the adoption of smokeless powder in 1890. As the discharge of guns and rifles no longer advertises their presence to the enemy by a cloud of smoke, concealment has become an essential factor in the design of all works.

The modern European fortress, entrenched camp, or fortified camp, as it is variously called, consists of a girdle of redoubts at a distance of from four to six miles from the edge of the defended place, and at intervals of from one to two and one-half miles, according to the nature of the country. These redoubts form a defensive screen behind which an army may encamp reasonably secure from danger of assault. Guns and howitzers are

placed in concealed positions behind the general line, to cover the intervals and to fire over the forts. For the transport and distribution of the great amount of ammunition and other stores required in the defence, all parts of the line are connected by

The extensive use of aircraft for observing the effect and accuracy of artillery fire, and for locating trenches and artillery positions, has made concealment of prime importance. The semi-permanent field work became the most important feature of for-

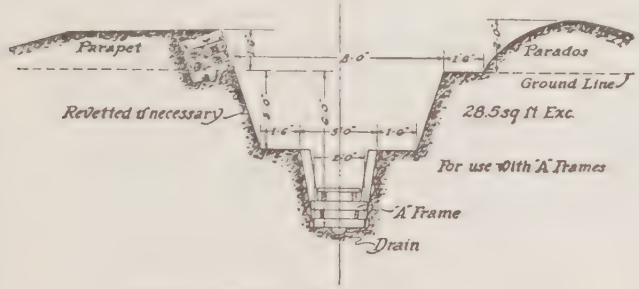


FIG. 5. —Standard profile, fire trench.

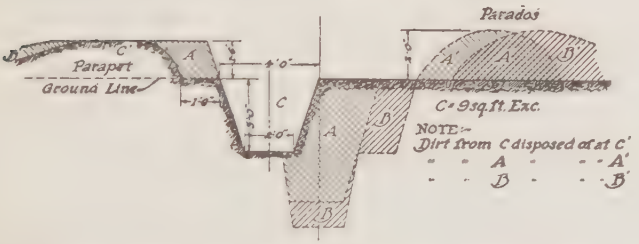
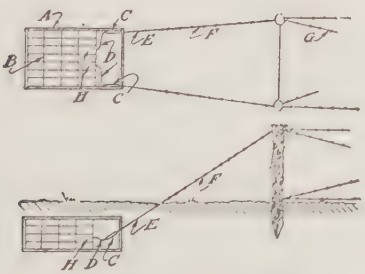


FIG. 6.—Simple standing trench, showing development into standard fire trench.



A Box
B Explosive Charge
D Instantaneous Fuses
E Smooth Wire
F Barbed Wire
G Barbed Wire Entanglement
H Tetryl Caps
C Friction Fuse Lighters (Stapled to wall of Box)

FIG. 7.—Anti-tank mine with a trip wire

Fortification.—III.

trench railways, good roads, and telephone and telegraph.

The effect of the powerful artillery in use by all belligerents during the World War was to push out still farther the main lines of defence. The importance of the detached fort or redoubt and the turret and armored cupola has diminished.

tresses remodelled as a result of the World War. The infantry trenches are pushed out as far as possible from the edge of the defended place, depending upon the size of the force available for the defence and the nature of the terrain. These trenches are made in several lines, with bombproofs, observation stations, machine-gun positions, communicating trenches leading to the rear, cover for supports and reserves, and finally a line of wire entanglement covering the whole front of the trenches. Behind the infantry lines the artillery is located in concealed positions. No detail is considered too trivial in order to conceal the guns from aeroplane observation. All such fortifications contain devices for detecting the approach of aircraft as well as search lights and anti-aircraft guns.

After 1930 a number of permanent fortification systems were built, the strongest being the French Maginot Line (q. v.) and the German Siegfried Line (q. v.). Military operations in the Russo-Finnish War and the war which began in 1939 proved that similar, weaker defense lines could be broken through; the Maginot Line, however, was taken only after French troops abandoned it because the Line was threatened in the rear.

Field Fortifications.—All the wars of the past fifty years have shown that troops will not remain long in the open exposed to heavy and accurate rifle and artillery fire without breaking and running for cover. As the range and accuracy of rifles and cannon have increased, so has the necessity for cover, especially to the inferior force—inferior in numbers, in training, or in *morale*—because of the longer time troops can be exposed to fire while crossing the fire-swept zone. The attacking force can advance only when they have developed superiority of fire. Entrenchments, by reducing the losses of the force occupying them, retard the development of fire superiority by the attacker, and may prevent its attainment entirely. Thus a numerically inferior army is able to withstand the attack of superior forces; or an attacking line that is unable to advance farther may hold on by digging in, despite the superior fire of the defence, until the arrival of reinforcements; or a general, by entrenching, may hold one part of his line with inferior forces, while he secretly concentrates the bulk of his command for a decisive attack at some other part.

Field fortifications were first used extensively during the American Civil War, although there are instances of their employment in previous wars. Since that time their use has steadily increased, until now the soldier's entrenching tool is considered secondary only to his arms and ammunition.

Previous to the World War, a field of fire to the front of five or six hundred yards was con-

sidered essential, and concealment was subordinated thereto. But the use of aeroplanes and observation balloons and of high-powered observing telescopes, and the unprecedented accuracy of artillery of all calibres, have served to emphasize the necessity of concealment. Trenches are sited so as not to be under artillery observation, if practicable, and also with regard to possible observing stations on ground occupied by the enemy. This point is regarded of great importance, and subsidiary to extensive field of fire.

A field of fire of two hundred yards is regarded as satisfactory, if it cannot be increased without loss of concealment from the enemy's observing stations. Of equal importance is the concealment of the obstacles in front of the trenches, as they can be destroyed by artillery fire, and the locating of the obstacle assists the hostile observer to locate and range upon the trenches.

Artillery fire has become so phenomenally accurate, and the effect of the high explosive shell in use so destructive, that the target must be reduced to the smallest possible dimensions. To this end field trenches are not constructed in continuous lines but in a series of mutually-supporting *strong points* garrisoned by about one hundred men, or *centres of resistance*, which may have as many as eight hundred riflemen in its area. In organizing the trench system each soldier digs an individual shelter which he shapes as a simple standing trench. (See Fig. 6.) These individual 'fox holes' are extended to connect with those to the right and left until the desired outline of the system is accomplished. The trenches are then improved by revetting and widening them until the standard type of trench is obtained. (See Fig. 5.) These entrenched positions are constructed for defence in any direction, including provisions for anti-aircraft fire, and the areas between them are covered by obstacles and by the fire of the supporting weapons of the infantry, *i.e.*, by machine guns, trench mortars, field artillery, and grenades. Machine gun emplacements are sometimes built in the front line, but usually they are placed in the support positions to guard against their loss in a surprise attack and to assist in breaking up any attack that may have penetrated the front line trenches. Carefully concealed observation posts and snipers' posts are included in the defensive organization.

During the night, or during a bombardment, all excepting a few men retire from the front line trench to dugouts (see Fig. 9) or to covered shelters in the rear areas of the defensive position. The trenches are habitually manned shortly before dawn, which is the most advantageous time for an attack. In the event of an attack they are manned as soon as the bombardment lifts from the first line trenches. In a well-constructed trench system shellproof shelters are customarily provided for dressing stations for the wounded, for unit command posts, and in the more quiet sectors, for the unit kitchens. The trenches of the supports and reserves have greater facilities for shelter from the enemy's fire than have the more advanced positions.

In view of the short field of fire provided in many locations, the *obstacle* (see Fig. 10) becomes of great importance to break up or check the enemy's attempts to rush the trenches, and to give time for the defenders to come from their dugouts in the cover trenches and man the firing trench. Barbed-wire entanglements are the most effective for this purpose, especially if concealed. (See Fig. 11). Traps for tanks are frequently placed in obstacles. (See Fig. 7.) When the trench lines come close together, as in many parts of the Western battle front in Europe, it is impossible to drive stakes in the repair of entanglements, and various expedients have been adopted to enable the repairs to be made at night without noise. These include triangles and crosses made from

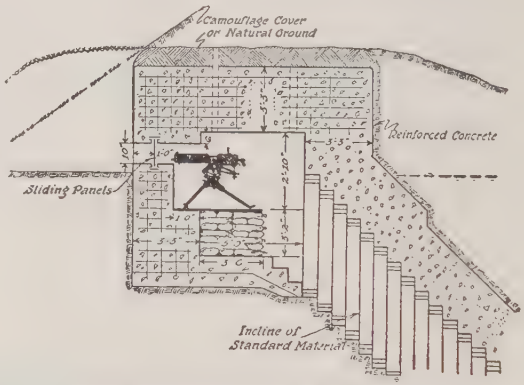


FIG. 8.—Shell-proof machine-gun emplacement connected with underground shelter

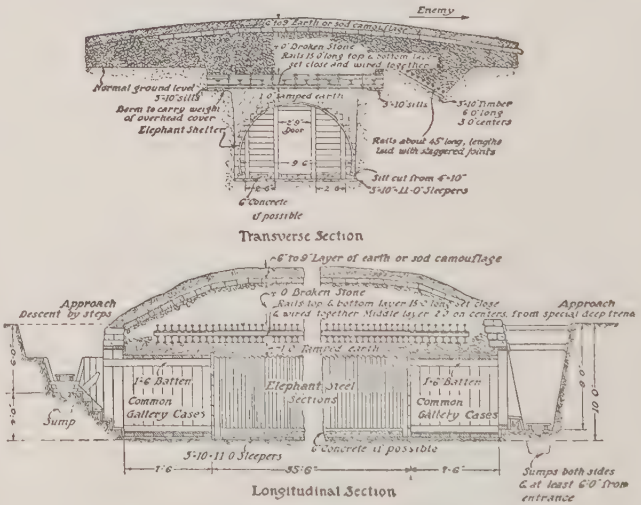

Enemy
6"to 9" Earth or sod camouflage
9" Broken Stone
Rails 15'0 long top & bottom layer set close and wired together
Normal ground level
3'-10" sills
Berm to carry weight of overhead cover
Elephant Shelter
Tamped earth
3'-10" sills
3'-10" Timber 6'0" long 3'0" centers
Rails about 45" long, lengths laid with staggered joints
Sill cut from 6'-10" 3'-10"-11'-0" Sleepers
6" Concrete if possible
Transverse Section
6"to 9" Layer of earth or sod camouflage
9" Broken Stone
Rails top & bottom layer 15'0" long set close & wired together Middle layer 2'0" on centers from special deep trench
Approach Descent by steps
Approach
Tamped earth
7'-6" Batter Common Gallery Cases
Elephant steel sections
7'-6" Batter Common Gallery Cases
Sump
3'-10"-11'0" Sleepers
6" Concrete if possible
1'-6"
35'-6"
1'-6"
Sumps both sides & at least 6'0" from entrance
Longitudinal Section

FIG. 9.—Cut-and-cover corrugated steel shelter

UNIT OF THE MAGINOT LINE IN EASTERN FRANCE, BETWEEN THE VOSGES AND LUXEMBOURG

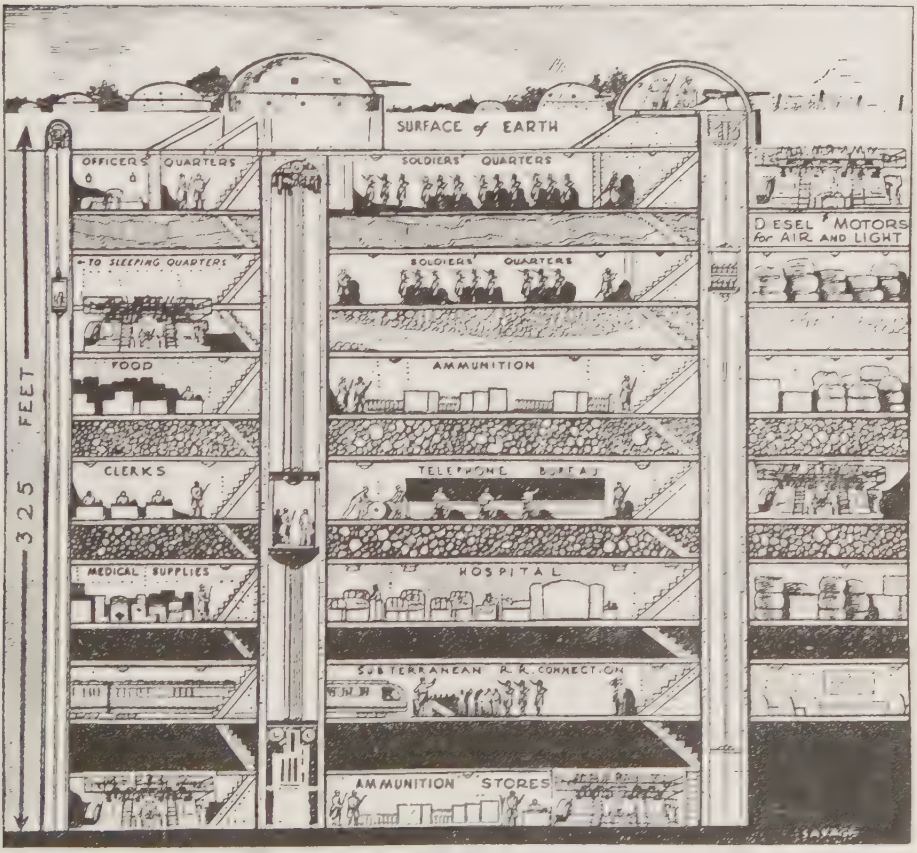


DIAGRAM OF A CROSS-SECTION OF THE FRENCH LINE OF FORTIFICATIONS CAPTURED BY THE GERMANS IN 1940. UNDERGROUND PASSAGEWAYS LINK THE SHELL AND BOMBPROOF VAULTS

limbs of trees lashed together in the trenches, and carried out to the front and erected at night.

troops, with the assistance of the engineers on technical matters, such as drainage, running levels,

FIG. 10.—Dead abatis blocking road with live abatis on its flank

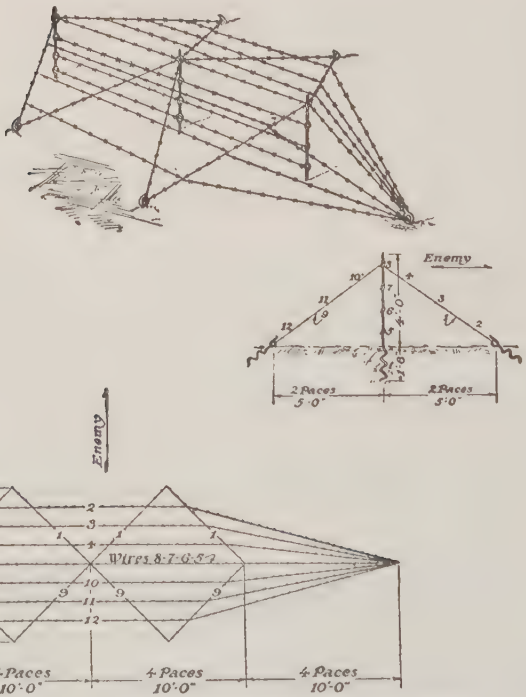


FIG. 11.— DOUBLE-APRON BARBED WIRE ENTANGLEMENTS.

Fortification.—V.

Field fortifications are designed and are usually located by engineer officers and troops; but they are built by the fighting

and staking out the works. Firing trenches are designed to develop a heavy short range frontal fire and permit the occupants to

stand and have free use of their bayonets when the time for personal contact arrives.

United States.—In this country the earliest fortifications were those built by the colonists for protection against the Indians, consisting generally of a rude stockade always kept in readiness for a siege, and into which all inhabitants were gathered at the first alarm. The Indian and Colonial wars developed more pretentious forts, many of them on the present sites of large cities. During the Revolutionary War strong fortifications were built at strategic places, and some of these are still in existence.

Between the close of the Revolutionary War and the beginning of the War of 1812, a number of fortifications were built; but they were mostly small, weak works, and through lack of proper maintenance soon lapsed into decay.

In 1816, pursuant to an act of Congress, a board of engineer and navy officers began a systematic study of the defence of the country. Gen. Simon Bernard, a noted French engineer, and Gen. J. G. Totten, chief of engineers of the U. S. Army for many years, were prominent engineering members of the board, which made a comprehensive report outlining the general policy that should be followed and the general principles governing the national defence, and submitted a fortification project covering the important harbors of the Atlantic and Gulf Coasts. The general policy, as stated by the board, was:

(1) The means of defence consist of (*a*) the Navy, (*b*) fortifications, (*c*) interior communications by land and water, and (*d*) a regular army and well-organized militia.

(2) Fortifications must close all important harbors against an enemy, and secure them to the nation's military and commercial marine.

(3) They must deprive the enemy of all strong positions, where, protected by naval superiority, he may fix permanent quarters in any territory and keep the whole frontier in perpetual alarm.

(4) They must cover the great cities from attack.

(5) They must prevent, as far as practicable, the great avenues of interior navigation from being blockaded near the entrances to the ocean.

(6) They must cover the coastwise and interior navigation by closing the harbors and several inlets from the sea which intersect the lines of communication, and thereby further aid the Navy

in protecting the navigation of the country.

(7) They must protect the great naval establishments.

Under the project of this board were built, among many others, such well-known forts as Fort Monroe, Va., Fort Adams, R. I., Fort Moultrie, S. C., and Fort Pickens, Fla. These were kept in a good state of preservation until after the close of the Civil War, but they became obsolete with the introduction of steel ships whether actually fortified or not. The land frontiers of the country are of such enormous extent that to fortify them adequately is manifestly out of the question. The land defences of Washington were allowed to decay after the close of the Civil War, and never have been rebuilt.

In the early eighties, renewed interest in the national defence was aroused, and the first decisive step to secure adequate modern coast defences was taken by report at what ports fortifications or other defences are most urgently required, the character and kind of defences best adapted to each with reference to armament, the utilization of torpedoes, mines, and other defensive appliances.' This board, known as the 'Endicott Board,' made its report in 1886, in which it set forth the principles of sea-coast defence, and formulated a complete scheme for the defence of American harbors based upon the best existing

Courtesy of U. S. Army Signal Corps Pictorial Service

Governors Island, N. Y., Center, Fort Jay, a bastioned fort; lower right, Castle Williams, old sea coast fort; upper right, Modern Barracks and Officers' Quarters.

and the development of high-power rifled guns afloat. The policies of defence laid down by the fortifications board of 1816 and the fortifications built under its project have exercised no little influence upon the history of the country. The Civil War defences of the city of Washington furnished a surprising example of the value of provisional fortification, and those of the Confederates at Fort Fisher showed the value of sand in front of parapets.

Since the Civil War all the permanent fortifications of the United States have been for coast defence, although all military posts are called forts,

Congress in the Act of March 3, 1883, which created a joint board of army and navy officers known as 'The Gun Foundry Board.' This board was created to report upon a location for a government foundry, or whatever other method should be adopted for the manufacture of heavy modern ordnance. Its report, published in 1884, directed public attention not only to the defenceless condition of the coasts, but to the importance and necessity of formulating a comprehensive scheme for the protection of harbors and coast cities.

As a result, Congress authorized a new board, by Act of March 3, 1885, to 'examine and

elements at that time. The board recommended high-power guns and mortars, mounted in turrets; armored casemates, gun lifts, floating batteries, and open emplacements; submarine mines, and torpedo boats. After the report of the board was adopted, the development of a disappearing gun carriage caused the substitution of open emplacements for the turrets and armored casemates; while the increased power and range of later guns, and the progress made in the science of engineering, rendered the floating batteries unnecessary.

During the twenty years following, many advances in all branches of engineering science

were recorded, and a revision of the whole fortification project was deemed desirable. Accordingly, the National Coast Defence Board, or 'Taft Board,' was created in January, 1905, by executive order to revise the project of the Endicott Board.

In February, 1915, a board was created in the War Department known as the Board of Review, to be a continuing board to pass on all matters relating to the revision, extension, or improvement of existing or projected fortifications. The developments of war material brought out by the World War and the war which began in 1939 influenced American coastal fortification, particularly in respect to providing armament of greater range and more ammunition to cope with the guns of longer range afloat, and anti-aircraft defences to guard against raids and observation from hostile aircraft. In the revision by the Board of Review, some harbors have been added, additional long-range armament has been provided at other harbors, and certain others have been reduced in importance to second line defences.

See Forts; Coast Defence; Guns.

Consult Fiebeger's *Permanent Fortification* and his *Field Fortification;* Clarke's *Fortification* (1907); *Engineer's Field Manual,* U. S. Army (1932); *Field Fortifications* (Command and General Staff School, Fort Leavenworth, Kans.); *Reports* of the U. S. War Department.

Fort Jackson. See Jackson, Fort.

Fort Jameson, an important centre in Northern Rhodesia, 120 miles west of Domira Bay, Lake Nyasa.

Fort Jay, U. S. Military post on Governors Island, New York Harbor, formerly known as Fort Columbus. The present fortifications were built in 1806, upon the site of an earlier earthwork. See Forts: Governors Island.

Fort Kampala, käm-pä'lä, town, Uganda, Central Africa, a little to the north of Port Alice, Victoria Nyanza.

Fort Kent, village, Aroostook county, Maine, on the northern boundary of the State, at the junction of the St. John and Fish Rivers, and on the Bangor and Aroostook Railroad; 200 miles north of Bangor. It is an agricultural and lumbering centre, and is the seat of Madawaska Training School for Teachers. There is an old blockhouse which was occupied by the First Regiment U. S. Heavy Artillery during the Aroostook War. Pop. (1930) 2,245.

Fort Lawton. See Forts.

Fort Leav'enworth, a U. S. military post in Leavenworth county, Kansas, 10 miles northwest of Kansas City, on the Missouri River. It was established in 1827 to protect the Santa Fe trail. A large garrison is stationed here, and it is the seat of the Army Command and General Staff School. See Forts.

Fort Lee, borough, New Jersey, Bergen county, on the Hudson River, at the lower end of the Palisades; 15 miles north of Jersey City, and opposite the upper part of Manhattan Island, with which it is connected by the George Washington Memorial Bridge. It has motion picture studios, and films are manufactured. During the American Revolution a fort occupied the site of the town, and here General Greene narrowly escaped capture by Cornwallis. A memorial shaft was erected by the State and the Sons of the American Revolution in 1908. Pop. (1930) 8,759.

Fort Lincoln. See Forts.

Fort Logan. See Forts.

Fort McAllister. See McAllister, Fort.

Fort McDowell. See Forts.

Fort McHen'ry, a former U. S. military post, one of the defences of Baltimore, Md., on Whetstone Point; established in 1794. A British fleet under Admiral Cockburn bombarded it in September, 1814, but was unable to reduce it. This bombardment inspired Francis Scott Key to write 'The Star-Spangled Banner.'

Fort McIntosh. See Forts.

Fort McKinley. See Forts.

Fort McPherson. See Forts.

Fort Mad'ison, city, Iowa, county seat of Lee county, on the Mississippi River, and the Atchison, Topeka and Santa Fe, and the Chicago, Burlington and Quincy Railroads, about 100 miles south of Cedar Rapids. The river is crossed here by a fine railroad and wagon bridge. The city is the seat of the Santa Fe and Sacred Heart Hospitals, the Cattermole Memorial Library, and a State penitentiary. The machine shops of the Atchison, Topeka, and Santa Fe Railroad are located here; and there are flour and saw mills, canneries, grain elevators, a pork-packing house, brick and cement block works, paper mills, and manufactures of farming tools, chairs, heaters, boots and shoes, boxes, and tools. The first settlement was made in 1808, at the time of the erection of the old fort, which was burned in 1813. Pop. (1940) 14,049.

Fort Meade. See Forts.

Fort Meigs. See Meigs, Fort.

Fort Mercer. See Mifflin, Fort.

Fort Mifflin. See Mifflin.

Fort Mills. See Mills, Fort.

Fort Monroe, or Fortress Monroe, fort and U. S. military post, Virginia, Elizabeth City county, on the Chesapeake and Ohio Railroad; 11 miles northeast of Norfolk. The fort is located at Old Point Comfort (q. v.), which is a popular seaside resort. Together with Fort Wool, it commands the entrance to Hampton Roads (q. v.), and is the headquarters of the harbor defences of Chesapeake Bay. The reservation covers an area of 282 acres, and includes the Coast Artillery School (see Military Education), post office, and telegraph station. The town of Phœbus (q. v.), is situated just outside the gates of the fort. Jefferson Davis was imprisoned at Fort Monroe for two years after the close of the Civil War. See Forts.

Fort Montgom'ery, built in 1777 near West Point to protect the Hudson River from the British fleet.

Fort Morgan. See Forts.

Fort Morgan, city, Colorado, county seat of Morgan county, on the South Platte River, and on the Chicago, Burlington and Quincy, and the Union Pacific Railroads; 70 miles northeast of Denver. Industries are stock raising, flour milling, and the manufacture of beet sugar. Pop. (1920) 3,818; (1930) 4,423.

Fort Moultrie. See Moultrie, Fort.

Fort Mruli, m'rōō'li (alt. 3,510 feet), in Uganda, Central Africa, on the Victoria Nile, is the old capital of Unyoro, and stands on the main road to Uganda; 480 miles northeast of Ujiji.

Fort My'er. See Forts.

Fort My'ers, city, Florida, county seat of Lee county, on the Caloosahatchee River, and the Atlantic Coast Line Railroad; 18 miles from the Gulf of Mexico. It is a popular resort for fishermen and sportsmen, and has canning and fishing industries. Pop. (1920) 3,678; (1940) 10,545.

Fort Niagara. See Niagara, Fort.

Fort Ninety-Six. See Ninety-Six.

Fort Oglethorpe. See Forts.

Fort Ontario. See Forts.

Fortopus, or Narenta, commune, Dalmatia, Jugoslavia; 70 miles southeast of Spalato. Pop. 10,000.

Fort Pickens. See Pickens, Fort.

Fort Pillow. See Pillow, Fort.

Fort Plain, village, New York, Montgomery county, on the Mohawk River, the New

York State Barge Canal, and the West Shore Railroad; 38 miles southeast of Utica. Industrial establishments include knitting and silk mills, creameries, machine shops, and wagon works. The village was settled in 1832. Pop. (1920) 2,747; (1930) 2,725.

Fort Preble. See FORTS.

Fort Pulaski. See PULASKI, FORT.

Fortress, the term sometimes used to denote a large permanent fortification or a number of forts. In the United States the only use of the term is in *Fortress Monroe,* an alternative name for Fort Monroe (q. v.).

Fortress Monroe. See FORT MONROE.

Fort Riley, a U. S. military post, Kansas, Riley county, on the Kansas River, 3 miles northeast of Junction City. The Army Cavalry School is located here. See FORTS.

Fort Robinson. See FORTS.

Fort Royal. See FORT DE FRANCE.

Forts. The term fort, in its strictest sense, is defined as 'a single enclosed work capable of independent defence; any fortification having a scarp and ditch, parapet or stockade, held by a garrison.' In the *United States,* however, the word is used to denote all permanent military posts or stations, whether fortified or not, and includes permanent camps, airfields, etc.

Forts in the stricter sense of the term, while absolutely required in early colonial times as a defence against hostile Indians, or for use in the colonial and Revolutionary wars, are no longer occupied; fortifications (q. v.) are built only along the sea coast. The garrisons of posts in the United States vary in size from a division to a company.

A modern infantry post consists of a large reservation to give room for drill and parade grounds, rifle ranges, and the required buildings. Along one side of the parade ground are located the officers' quarters. On the opposite side of the parade are placed the barracks, sometimes a separate building for each company, but frequently all under one roof. In addition, there are quarters for the post non-commissioned staff, a hospital, drill hall, post exchanges, stables, garages, gymnasium, storehouses for the quartermaster, ordnance, and signal officers, guard house, administration building, chapel, etc.

The accompanying table gives a list of the principal forts and air fields of the United States (1936), together with their corps area and geographical location. Some of the posts of historic in-

Principal Forts of the United States

Adams, Ft. (First).—Newport, R. I.
Albrook Field (P. C. Dept.).—Quarry Heights, C. Z.
Allen, Ft. Ethan (First).—Ft. Ethan Allen, Vt.
Amador, Ft. (P. C. Dept.).—Balboa, C. Z.
Anchorage, Alaska (Atchd. Ninth).—Anchorage, Alaska.
Andrews, Ft. (First).—Ft. Andrews, Mass.
Armstrong, Ft. (H. Dept.).—Honolulu, Hawaii.

Baker, Ft. (Ninth).—Sausalito, Calif.
Banks, Ft. (First).—Boston, Mass.
Barksdale Field (Fourth).—Shreveport, La.
Barrancas, Ft. (Fourth).—Ft. Barrancas, Fla.
Barry, Ft. (Ninth).—Ft. Barry, Calif.
Belvoir, Ft. (Third).—Ft. Belvoir, Va.
Benning, Ft. (Fourth).—Ft. Benning, Ga.
Bliss, Ft. (Eighth).—Ft. Bliss, Tex.
Bolling Field (Third).—Anacostia, D. C.
Boyd, Camp (Eighth).—Ft. Bliss, Tex.
Brady, Ft. (Sixth).—Sault Ste. Marie, Mich.
Bragg, Ft. (Fourth).—Ft. Bragg, N. C.
Brooks Field (Eighth).—San Antonio, Tex.
Brown, Ft. (Eighth).—Brownsville, Tex.
Bullis, Camp (Eighth).—San Antonio, Tex.

Canby, Ft. (Ninth).—Ilwaco, Wash.
Carlisle Barracks (Third).—Carlisle, Pa.
Casey, Ft. (Ninth).—Ft. Casey, Wash.
Chanute Field (Sixth).—Rantoul, Ill.
Chapman Field (Fourth).—Miami, Fla.
Chigas, Camp (Eighth).—El Paso, Tex.
Chilkoot Barracks (Atchd. Ninth).—Haines, Alaska.
China, American Forces in.—Tientsin, China.
Clark Field (P. Dept.).—Ft. Stotsenburg, P. I.
Clark, Ft. (Eighth).—Brackettville, Tex.
Clayton, Ft. (P. C. Dept.).—Ft. Clayton, C. Z.
Columbia, Ft. (Ninth).—Ft. Columbia, Wash.
Constitution, Ft. (First).—Newcastle, N. H.
Corozal, Post of (P. C. Dept.).—Corozal, C. Z.
Crissy Field (Ninth).—Presidio Station, Calif.
Crockett, Ft. (Eighth).—Galveston, Tex.
Crook, Ft. (Seventh).—Ft. Crook, Nebr.
Cuartel de España (P. Dept.).—Manila, P. I.
Cuartel de Infanteria (P. Dept.).—Manila, P. I.
Custer, Camp (Sixth).—Camp Custer, Mich.

Dade, Ft. (Fourth).—Ft. Dade, Fla.
Davis, Ft. Wm. D. (P. C. Dept.).—Gatun, C. Z.
Delaware, Ft. (Second).—Delaware City, Del.
De Lesseps, Ft. (P. C. Dept.).—Cristobal, C. Z.
De Russy, Ft. (H. Dept.).—Honolulu, Hawaii.
Des Moines, Ft. (Seventh).—Ft. Des Moines, Iowa.
De Sota, Ft. (Fourth).—Tampa, Fla.
Devens, Camp (First).—Camp Devens, Mass.
Dix, Camp (Second).—Camp Dix, N. J.
Dodge, Camp (Seventh).—Camp Dodge, Ia.
Douglas, Ft. (Ninth).—Ft. Douglas, Utah.
Drum, Ft. (P. Dept.).—Manila, P. I.
Du Pont, Ft. (Second).—Delaware City, Del.
Duvall, Ft. (First).—Boston, Mass.

Eagle Pass, Camp (Eighth).—Eagle Pass, Tex.
Eldridge, Camp (P. Dept.).—Los Banos, Laguna, Luzon, P. I.
Ellington Field (Eighth).—Houston, Tex.
Estado Mayor (P. Dept.).—Manila, P. I.
Eustis, Ft. (Third).—Ft. Eustis, Va.

Fisherman's Island (Third).—Kiptopeke, Va.
Fitzsimons Gen. Hosp. (Eighth).—Denver, Colo.
Flagler, Ft. (Ninth).—Ft. Flagler, Wash.
Foster, Ft. (First).—Kittery, Me.
France Field (P. C. Dept.).—Cristobal, C. Z.
Frank, Ft. (P. Dept.).—Manila Bay, P. I.
Funston, Ft. (Ninth).—San Francisco, Calif.

Getty, Ft. (First).—Ft. Greble, R. I.
Gibbon, Ft. (Atchd. Ninth).—Tanana, Alaska.
Governors Island, N. Y. (Second).—New York, N. Y.
Grant, Camp (Sixth).—Camp Grant, Ill.
Grant, Ft. (P. C. Dept.).—Balboa, C. Z.
Gray's Harbor, Wash. (Ninth).—McGowan, Wash.
Greble, Ft. (First).—Ft. Greble, R. I.

Hamilton Field (Ninth).—San Rafael, Calif.
Hamilton, Ft. (Second).—Ft. Hamilton, Brooklyn, N. Y.
Hancock, Ft. (Second).—Ft. Hancock, N. J.
Harrison, Ft. Benjamin (Fifth).—Ft. Benjamin Harrison, Ind.
Hay, Camp John (P. Dept.).—Baguio, Luzon, P. I.
Hayes, Ft. (Fifth).—Ft. Hayes, Ohio.
Heath, Ft. (First).—Boston, Mass.
Henry Barracks (Atchd. Second).—Cayey, Puerto Rico.

Principal Forts of the United States—Continued

Houston, Ft. Sam (Eighth).—Ft. Sam Houston, Tex.
Howard, Ft. (Third).—Ft. Howard, Md.
Hoyle, Ft. (Third).—Edgewood, Md.
Huachuca, Ft. (Eighth).—Ft. Huachuca, Ariz.
Hughes, Ft. (P. Dept.).—Manila, P. I.
Humphreys, Ft.—Washington, D. C.
Hunt, Ft. (Third).—Ft. Hunt, Va.

Jay, Ft. (Second).—New York City, N. Y.
Jefferson Barracks (Sixth).—Jefferson Barracks, Mo.

Kamehameha, Ft. (H. Dept.).—Ft. Kamehameha, Hawaii.
Kearny, Ft. Philip (First).—Ft. Greble, R. I.
Kelly Field (Eighth).—Kelly Field, Tex.
Key West Barracks (Fourth).—Key West, Fla.
Kindley Field (P. Dept.).—Ft. Mills, Corregidor, P. I.
Knox, Ft. (Fifth).—Ft. Knox, Ky.

Langley Field (Third).—Hampton, Va.
Lawton, Ft. (Ninth).—Seattle, Wash.
Leavenworth, Ft. (Seventh).—Leavenworth, Kan.
Lee Hall, Va. (Third).—Lee Hall, Va.
Levett, Ft. (First).—Portland, Me.
Lewis, Ft. (Ninth).—Ft. Lewis, Wash.
Lincoln, Ft. (Seventh).—Bismarck, N. D.
Logan, Ft. (Eighth).—Ft. Logan, Colo.
Luke Field (H. Dept.).—Luke Field, Hawaii.
Lyon, Ft. (First).—Portland, Me.

MacArthur, Ft. (Ninth).—San Pedro, Calif.
McClellan, Ft. (Fourth).—Ft. McClellan, Anniston, Ala.
McCoy, Camp (Sixth).—Sparta, Wis.
McDowell, Ft. (Ninth).—Angel Island, Calif.
McIntosh, Ft. (Eighth).—Laredo, Tex.
McKinley, Ft. (First).—Portland, Me.
McKinley, Ft. Wm. (P. Dept.).—Guadalupe, Rizal, Luzon, P. I.
McPherson, Ft. (Fourth).—Ft. McPherson, Ga.
McRee, Ft. (Fourth).—Ft. Barrancas, Fla.
Madison Barracks.—Sacketts Harbor, N. Y.
Manila, Post of (P. Dept.).—Manila, Luzon, P. I.
March Field (Ninth).—March Field, Calif.
Marshall Field (Seventh).—Ft. Riley, Kans.
Mason, Ft. (Ninth).—San Francisco, Calif.
Mather Field (Ninth).—Mills, Calif.
Maxwell Field (Fourth).—Montgomery, Ala.
Meade, Ft. George G. (Third).—Ft. Meade, Md.
Meade, Ft. (Seventh).—Ft. Meade, S. Dak.
Michie, Ft. (Second).—New London, Conn.
Miley, Ft. (Ninth Corps Area).—San Francisco, Calif.
Miller Field (Second).—Staten Island, N. Y.
Mills, Ft. (P. Dept.).—Cavite, Corregidor Island, Manila Bay.
Missoula, Ft. (Ninth).—Missoula, Mont.
Mitchel Field.—Garden City, N. Y.
Monmouth, Ft. (Second).—Oceanport, N. J.
Monroe, Ft. (Third).—Fort Monroe, Va.
Morgan, Ft. (Fourth).—Ft. Morgan, Ala.
Mott, Ft. (Second).—Salem, N. J.
Moultrie, Ft. (Fourth).—Moultrieville, S. C.
Myer, Ft. (District of Washington).—Fort Myer, Va.

Niagara, Ft. (Second).—Youngstown, N. Y.
Nichols Field (P. Dept.).—Maricaban, Rizal, Luzon, P. I.

Oglethorpe, Ft. (Fourth).—Ft. Oglethorpe, Ga.
Omaha, Ft. (Seventh).—Omaha, Nebr.
Ontario, Ft. (Second).—Oswego, N. Y.

Pettit Barracks (P. Dept.).—Zamboanga, Moro, Mindanao, P. I.
Pickens, Ft. (Fourth).—Ft. Barrancas, Fla.
Pine Camp (Second).—Pine Camp, N. Y.
Pio Pico, Ft. (Ninth).—San Diego, Calif.
Plattsburg Barracks (Second).—Plattsburg, N. Y.
Preble, Ft. (First).—Portland, Me.
Presidio of Monterey (Ninth).—Presidio of Monterey, Calif.
Presidio of San Francisco (Ninth).—Presidio Station, San Francisco, Calif.

Quarry Heights (P. C. Dept.).—Balboa Heights, C. Z.

Randolph, Ft. (P. C. Dept.).—Cristobal, C. Z.
Reno, Ft. (Eighth).—Ft. Reno, Okla.
Revere, Ft. (First).—Hull, Mass.
Riley, Ft. (Seventh).—Ft. Riley, Kan.
Ringgold, Ft. (Eighth Corps Area).—Rio Grande City, Tex.
Robinson, Ft. (Seventh).—Ft. Robinson, Nebr.
Rodman, Ft. (First).—New Bedford, Mass.
Rosecrans, Ft. (Ninth).—Point Loma, Calif.
Ross Field (Ninth).—Arcadia, Calif.
Ruckman, Ft. (First).—Boston, Mass.

terest or of special importance will be found described in separate articles under their own heads.

See FORTIFICATION; COAST ARTILLERY; ARMY OF THE U. S. ARMY LIST AND DIRECTORY, U. S.

Fort Sam Houston. See FORTS.

Fort San Jacinto. See FORTS.

Fort Schuyler. See STANWIX, FORT.

Fort Schuyler, ski'ler, U. S. military post, one of the defences of the northern entrance to New York Harbor, is situated on Throgs Neck, Long Island Sound, 3½ miles from Westchester station, New York City. It is a subpost of Fort Totten (q. v.).

Fort Scott, city, Kansas, county seat of Bourbon county, on the Marmaton River, and the St. Louis and San Francisco, the Missouri Pacific, and the Missouri, Kansas and Texas Railroads; 98 miles south of Kansas City. Here the Jefferson Highway from Winnipeg to New Orleans crosses the direct route from St. Louis to California. The city is the seat of Mercy Hospital and Goodlander Home. Establishments include railroad and machine shops and foundries, grain elevators and flour mills, tile works, a large milk condensery, syrup factory, cement and brick plants, and harness factories. The surrounding country is a region of unusual fertility and the city is a shipping point for corn, wheat, dairy products, flax, cattle, coal, and cement rock. It has the commission form of government. Pop. (1940) 10,511.

Fort Screven. See FORTS.

Fort Sheridan. See FORTS.

Fort Slocum. See FORTS.

Fort Smith, city, Arkansas, county seat of Sebastian county, at the junction of the Arkansas and Poteau Rivers, on the Arkansas–Oklahoma State line and on the St. Louis–San Francisco, the Fort Smith and Western, the Kansas City Southern, the Midland Valley, and the Missouri Pacific Railroads; 130 miles northwest of Little Rock. Four steel bridges here cross the Arkansas and Poteau Rivers. Important buildings and institutions are the U. S. Court House and Post Office, St. Anne's Academy, Belle Point Hospital, St. Edward's Infirmary, Peabody public school, and a high school. The old fort and the national cemetery are features of interest.

Industries include lumber mills, iron and steel rolling mills, and manufactures of furniture, wagons, textile, glass, cottonseed

oil, brooms, and cutlery. The city is the centre of a region rich in coal and agricultural products, and has a large trade. Commission government was adopted in 1913. Pop. (1930) 31,429; (1940) 36,540.

Fort Snelling. See FORTS.

Fort Stanwix. See STANWIX, FORT.

Fort Stephenson. See FREMONT, OHIO.

Fort Strong. See FORTS.

Fort Sumter. See SUMTER.

Fort Terry. See FORTS.

Fort Thomas. See FORTS.

Fort Ticonderoga. See TICONDEROGA, FORT.

Fort Tot'ten, a U. S. military post on Long Island, New York, at the western end of Long Island Sound; 2 miles east of Whitestone. It is one of the chief defences of the northern entrance to New York Harbor. Anti-aircraft units are located here. See FORTS.

Fortuna, for-tōō'na, called by the Greeks *Tyche,* was in classical mythology the goddess of chance. She differed from Destiny or Fate in so far as she worked without law, giving or taking away at her own pleasure, and dispensing joy or sorrow indifferently.

Fortunate Isles. See ISLES OF THE BLEST.

Fortuna'tus, the hero of an old and popular romance. The substance of the story is that Fortunatus and his sons after him are the possessors of an inexhaustible purse of gold and a wishing cap, which, however, in the end, prove the cause of their ruin. The moral is that worldly prosperity alone is insufficient to produce lasting happiness. The story in its existing form dates only from 1509, when the earliest known edition appeared at Augsburg.

Fortunatus, VENANTIUS HONORIUS CLEMENTIANUS (*c.*530–*c.*600), ecclesiastic and poet, was born near Treviso, Italy. He studied at Ravenna, and travelled through Germany and France, eventually taking up his residence at Poitiers, where he became the friend of Queen Radegunda and Gregory of Tours. He entered the priesthood, and shortly before his death was made bishop of Poitiers. He was the leading Latin poet of his day.

For'tune, ROBERT (1813–80), Scottish botanist and traveller, was born in Edrom, Berwickshire. After serving as gardener in the Royal Botanic Garden, Edinburgh, and in London, he was commissioned in 1843 to visit China for the Botanical Society of London. He published the results of that trip in *Three Years' Wanderings in Northern China* (1847). He subsequently visited China on three occasions, to study tea cultivation, to carry plants from that country to India, and to collect seeds and plants for the Government of the United States. His other books are: *A Journey to the Tea Countries of China* (1852); *A Residence Among the Chinese* (1857); *Yedo and Peking* (1863).

Fortune Bay, a bay on the south coast of Newfoundland. Brunet Island is situated at its entrance, and to the southwest are the islands of St. Pierre and Great and Little Miquelon, small fishing islands belonging to France.

Fortune Telling, the act of predicting future events, as by the inspection of tea leaves in a cup, the reading of playing cards, palmistry, astrology, and crystal gazing. In England, any person who pretends or proposes to tell fortunes is punishable under the Vagrancy Act as a rogue and a vagabond; while in the United States professional fortune tellers are generally classed as disorderly persons, and may be punished for misdemeanor. See ASTROLOGY; DIVINATION; ORACLES; PALMISTRY.

Fortuny y Carbo, for-tōō'nē ē kär'bō, MARIANO JOSÉ MARIA (1838–74), an eminent Spanish painter and etcher, was born in Réus, Catalonia. He studied under Lorenzalez at the academy in Barcelona, and at the age of eighteen won the Prix de Rome, which enabled him to study there the art of the old masters. While serving on the staff of General Prim during the war in Morocco (1859–60) he began to sketch Oriental scenes, and to form the style which became

Principal Forts of the United States—Concluded

Ruger, Ft. (H. Dept.).—Honolulu, Hawaii.
Russell, Ft. D. A. (Ninth).—Marfa, Tex.

San Jacinto, Ft. (Eighth).—Galveston, Tex.
San Juan (Atchd. Second).—San Juan, Puerto Rico.
Saulsbury, Ft. (Second).—Milford, Del.
Schofield Barracks (H. Dept.).—Schofield Barracks, Hawaii.
Schuyler, Ft. (Second).—Westchester, N. Y.
Scott Field (Sixth).—Belleville, Ill.
Scott, Ft. Winfield (Ninth).—Ft. Winfield Scott, Calif.
Screven, Ft. (Fourth).—Ft. Screven, Ga.
Selfridge Field (Sixth).—Mount Clemens, Mich.
Shafter, Ft. (H. Dept.).—Shafter, Hawaii.
Sheridan, Ft. (P. C. Dept.).—Ft. Sheridan, Ill.
Sherman, Ft. (P. C. Dept.).—Cristobal, C. Z.
Sill, Ft. (Eighth).—Ft. Sill, Okla.
Slocum, Ft. (Second).—Ft. Slocum, N. Y.
Snelling, Ft. (Seventh).—Fort Snelling, Minn.
Standish, Ft. (First).—Boston, Mass.
Stanley, Camp (Eighth).—San Antonio, Tex.
Stark, Ft. (First).—Portsmouth, N. H.
Sternberg, Gen. Hosp. (P. Dept.).—Manila, P. I.
Stevens, Ft. (Ninth).—Ft. Stevens, Ore.
Story, Ft. (Third).—Cape Henry, Va.
Stotsenburg, Ft. (P. Dept.).—Angeles, Pampanga, Luzon, P. I.
Strong, Ft. (First).—Boston, Mass.
Sumter, Ft. (Fourth).—Moultrieville, S. C.

Taylor, Ft. (Fourth).—Key West, Fla.
Terry, Ft. (Second). (Atchd. to First).—Ft. Terry, N. Y.
Thomas, Ft. (Fifth).—Ft. Thomas, Newport, Ky.
Tilden, Ft. (Second).—Ft. Tilden, Rockaway Park, L. I.
Totten, Ft. (Second).—Ft. Totten, N. Y.
Townsend, Ft. (Ninth).—Port Townsend, Wash.
Travis, Ft. (Eighth).—Galveston, Tex.
Tripler, Gen. Hosp. (H. Dept.).—Honolulu, Hawaii.

Valdez (Atchd. Ninth).—Valdez, Alaska.
Vancouver Barracks (Ninth).—Vancouver, Wash.

Wadsworth, Ft. (Second).—Rosebank, Staten Island, N. Y.
Ward, Ft. (Ninth).—Ft. Ward, Wash.
Warren, Ft. (First).—Boston, Mass.
Warren, Ft. Francis E. (Eighth).—Cheyenne, Wyo.
Washington, Ft. (Third).—Fort Washington, Md.
Wayne, Ft. (Sixth).—Detroit, Mich.
Weaver, Ft. (H. Dept.).—Pearl Harbor, Honolulu, Hawaii.
West Point (Second).—West Point, N. Y.
Wetherill, Ft. (First).—Jamestown, R. I.
Wheeler Field.—Schofield Barracks, Hawaii.
Whitman, Ft. (Ninth).—La Conner, Wash.
Williams, Ft. (First).—Cape Cottage, Me.
Willapa Bay (Ninth).—Willapa, Wash.
Wint, Ft. (Phil. Dept.).—Manila, P. I.
Wood, Ft. (Second).—New York, N. Y.
Wool, Ft. (Third).—Fort Monroe, Va.
Worden, Ft. (Ninth).—Port Townsend, Wash.
Wright, Ft. George (Ninth).—Spokane, Wash.
Wright, Ft. H. G. (Second).—Fisher's Island, N. Y.

characteristic of his later work—gorgeous color, subtly interblended with sunlight. Upon his return from Morocco he was commissioned by the city of Barcelona to paint *The Battle of Tetuan,* which remains, unfinished, in the municipal building.

Between 1860 and 1865, Fortuny, having acquired a mastery of technique, worked as a designer. In 1866 he went to Paris, where he frequented the studios of Gérôme and Meissonier, and painted a decorative picture for Queen Christine's Parisian hotel. Returning to Rome, he established a studio which became the centre of a brilliant literary and artistic circle.

The work of Fortuny has been a dominating influence in the art of his native country, and he easily holds rank among the great painters of the nineteenth century. Among his best known works are *The Arabian Fantasia, The Hindu Snake Charmer, The Tribunal of a Cadi, The Praying Arab, The Spanish Marriage* (1868), *The Espada* (1869), *The Selection of a Model* (1870), and *The Garden of a Poet.* Many of his paintings are in public and private collections in the United States, including *The Hindu Snake Charmer, The Poet, The Rehearsal, The China Vase, Don Quixote, An Ecclesiastic,* and *The Mendicant,* in the Walters Gallery, Baltimore; *Lady in Black, A Court Fool,* and *Arab Fantasia at Tangiers,* in the Metropolitan Museum of Art, New York City; and *The Butterfly* and *The Selection of a Model,* owned by William A. Clark of New York City. Consult *Life* in French by C. Davillier and by Yriarte; Downes' *Twelve Great Artists.*

Fort Valley, city, Houston county, Georgia, on the Central of Georgia and the Southern Railroads; 29 miles south of Macon. It has a cotton mill and cotton gin, a knitting mill, basket factory, crate factory, and six canneries, and is an extensive shipping point for peaches. Pop. (1920) 3,223; (1930) 4,560.

Fort Wadsworth, a United States military post situated on Staten Island, N. Y. It was established in 1827 and named for General Wadsworth, who lost his life in the Battle of the Wilderness. See Forts.

Fort Warren, a United States military post, situated on Georges Island, seven miles southeast of Boston, Mass. The fort was established in 1861, and served as a military prison during the Civil War. See Forts.

Fort Washington, a military post of the American Revolution, situated on the northwest heights of Manhattan Island. The fort was built in 1776 by Gen. Charles Lee in an endeavor to block the Hudson against the British. Washington, realizing that so small a garrison would prove to be only a trap, wanted to abandon it, but yielded to the wishes of Greene and Congress. The garrison was occupied by 2,800 men, under the command of Colonel Magaw. Full plans and descriptions of the fort were given by a deserter to Sir William Howe, who, on Nov. 16, 1776, attacked it with a force of 15,000 men. Driven from the heights and penned in the fort, the entire garrison surrendered, yielding to the British 161 cannon and immense stores of supplies.

Fort Washington, a United States military post on the Potomac River, near Washington, D. C. See Forts.

Fort Wayne, a United States military post near Detroit, Mich. See Forts.

Fort Wayne, city, Indiana, county seat of Allen county, situated at the confluence of St. Joseph's and St. Mary's Rivers, on the New York, Chicago, and St. Louis, the Pennsylvania, the Wabash, the Lake Shore and Michigan Southern, and the Lake Erie and Western Railroads; 144 miles southeast of Chicago. The chief buildings and institutions are the Federal Building, Allen County Court House (costing $1,000,000), St. Joseph's, Hope, and Lutheran Hospitals, the State School for Feeble-Minded Youth, Concordia College, Sacred Heart Academy, St. Augustine's Academy, and Fort Wayne Art School and Conservatory of Music.

Fort Wayne is situated in an agricultural region, for which it is the chief distributing centre, and has many important industries. The principal industries are printing and publishing and the manufacture of foundry and machine shop products, lumber and timber, bakery products, flour and grist mill products, hosiery, oil tanks and pumps, electrical apparatus, tobacco, druggists' preparations, confectionery, carriages and wagons, marble and stone work, and leather goods.

The city government is administered by a municipal council consisting of the mayor and one member from each of the ten wards. The mayor appoints the boards of public works and public safety, the health commissioner, park and street superintendents, city attorney, and city controller. Almost ninety per cent of the inhabitants of Fort Wayne are American born. Pop. (1920) 86,549; (1930) 114,946; (1940) 116,190.

The site of Fort Wayne was formerly the chief village of the Miami Indians. In 1790 American troops, under General Harmar, burned the village, and in 1794 Gen. Anthony Wayne erected a fort here, which withstood a determined Indian attack in 1812. Fort Wayne was chartered as a city in 1839, and grew rapidly during the period of railroad development between 1850 and 1860.

Fort William. See Calcutta.

Fort William, city, Thunder Bay District, Ontario, Canada, situated at the head of navigation on Lake Superior, and at the terminus of the Canadian Pacific, the Grand Trunk Pacific, and the Canadian Northern Railroads; 3 miles south of Port Arthur, and 420 miles southeast of Winnipeg. Public buildings include the City Hall, Court House, public library, collegiate institute, and two hospitals. The city has excellent harbor and shipping facilities, and is an important outlet for the wheat trade of Western Canada, its grain elevators having a total capacity of more than 30,000,000 bushels. Other industries comprise foundries, flour mills, shipbuilding, cement block works, brick yards, breweries, and broom, door, and sash factories. Pop. (1911) 16,499; (1921) 20,086; (1931) 26,277.

Fort William Henry. See William Henry.

Fort Williams. See Forts.

Fort Winfield Scott. See Forts.

Fort Wint. See Forts.

Fort Wool. See Forts.

Fort Worden. See Forts.

Fort Worth, city, Texas, county seat of Tarrant county, situated on the Trinity River; 32 miles west of Dallas. It is served by eleven trunk line railroads—the St. Louis Southwestern; Texas and Pacific; Gulf, Colorado and Santa Fe; Fort Worth and Denver City; Chicago, Rock Island and Gulf; Missouri, Kansas and Texas; Frisco Lines; Trinity and Brazos Valley; Houston and Texas Central; International and Great Northern; and the Texas and New Orleans. The city has a good system of roads, nearly 225 miles of paved streets, and 31 public parks and playgrounds, covering 432 acres.

Noteworthy buildings are the fine County Court House, the City Hall, the Hotel Texas, the Farmers' and Mechanics' Bank Building, the W. T. Waggoner Building, and the Union Station. Educational and philanthropic institutions include the Texas

THE ROMAN FORUM AS IT APPEARS TODAY

THE ROMAN FORUM AS IT APPEARED AT THE HEIGHT OF ANCIENT ROME'S POWER

(Reconstruction after Professor E. Benetti)

Woman's College (formerly the Polytechnic College), Texas Christian University, Southwestern Baptist Theological Seminary, Academy of Our Lady of Victory and Mount Carmel Academy, Masonic Orphans' and Widows' Home of Texas, St. Joseph's Sanitarium, and Protestant Sanitarium.

Fort Worth is situated in a rich stock-raising, grain, and cotton district, and has exceptional railway facilities. Just outside the corporate limits of the city are located some of the most important slaughtering and meat-packing establishments in the south. Other industries comprise flour and grist and rice-cleaning mills, cotton and oil mills, printing and publishing houses, petroleum refineries, ice plants, railway car and repair shops, foundries and machine shops, rolling mills, and manufactures of furniture, clothing, bakery products, chemicals, candy, automobiles, and wagons. The city has a large storage dam on the Trinity River, with a capacity of 30,000,000,000 gallons.

Fort Worth was founded as a military post in 1849. Since 1900 the growth of the city has been extremely rapid and in 1907 the commission form of government was adopted. In 1909 the city suffered from a $2,000,000 fire, and in 1922 floods caused a small loss of life and a property loss of over $1,000,000. Pop. (1900) 26,688; (1910) 73,312; (1920) 106,482; (1930) 163,447; (1940) 177,748.

'Forty-five, The, in English history, means the year 1745, which witnessed the second great effort of the Jacobites to overthrow the Hanoverian dynasty in Britain. See Stuart, Charles Edward.

Forty Fort, borough, Luzerne county, Pennsylvania, on the Susquehanna River and the Lehigh Valley and Lackawanna Railroads; 3 miles north of Wilkes-Barre. It is situated in a coal-mining district, and has machine shops. Here occurred the Wyoming Massacre (q. v.). Pop. (1920) 3,389; (1930) 6,224.

Forty Immortals, a term generally applied to the members of the Académie Française (French Academy), the history of which is related under Academy (q. v.). The membership, in April, 1936, was composed of the following; the year in which they were elected (for life) is shown.

Gabriel Hanotaux (1897); Henri Emile Lavedan (1898); Maurice Donnay (1907); René Doumic (1909); Marcel Prévost (1909); Henri de Regnier (1911); Henri Bergson (1914); Alfred Baudrillart (1918); Henri Bordeaux (1919); Joseph Bédier (1920); Louis Chevrillon (1920); Pierre de Nolhac (1922); Georges Goyau (1922); Edouard Estaunié (1923); Henri Robert (1923); Georges Lecomte (1924); Emile Picard (1924); A. de Caumont (Duc de la Force, 1925); Louis Bertrand (1925); Paul Valéry (1925); Abel Hermant (1927); Émile Mâle (1927); Louis Madelin (1927); Maurice Paléologue (1928); Maréchal Pétain (1929); André Chaumeix (1930); Pierre Benoit (1931); Général Weygand (1931); Abel Bonnard (1932); François Mauriac (1933); Duc de Broglie (1934); Léon Bérard (1934); Maréchal Franchet d'Esperey (1934); André Bellessort (1935); Claude Farrère (Frederick Bargorne, 1935); Jacques Bainville (1935); Georges Duhamel (1935); Louis Gillet (1935).

There were two vacancies when this list was compiled.

Forty-Niners, the name given to those immigrants who, in 1849, were drawn to California by the gold discoveries of 1848. Within the year about 42,000 immigrants arrived by land and 30,000 by sea, the great mass being from the United States, although Latin America furnished a large number. Those from the Atlantic slope came mainly by sea, either rounding Cape Horn, or going to Chagres, whence they crossed the Isthmus to Panama; those nearer West came chiefly by prairie schooner, crossing the plains, the Great Desert, and the Rocky Mountains. Either journey was fraught with hardships and danger of death.

Those who came by land gathered at St. Joseph or Independence, Mo., and started forward about June, the first wagon reaching Sacramento in August. By sea, the first arrival was the *California*, a vessel of the Pacific Mail Steamship Company, which had started around the Horn before the discoveries were known and had subsequently enlisted as passengers 75 Peruvians and more than 1,000 Americans. The *California* reached San Francisco on Feb. 28, 1849, the *Oregon* and *Panama* bringing, later, still larger crowds. Throngs attempted the journey in any craft available, and many were lost by the way.

The immigrants were of every nationality, class, and color; cadets of rich families, drawn by adventure and the wish to found their own fortunes; young men fresh from college; shopkeepers selling out small businesses; plain farmers and workmen; as well as criminals of the worst stamp. All struggled, fought, and fused into a new type, aptly portrayed by Bret Harte in *The Argonauts of '49*. Consult also Bayard Taylor's *El Dorado* (letters on the Isthmus voyage and after arrival); Stillman's *Seeking the Golden Fleece;* H. H. Bancroft's *California inter Pocula;* Royce's *California;* McIlhany's *Recollections of a Forty-Niner;* Audubon's *Western Journal, 1849–50;* White's *The Forty-Niners* (1918).

Forty Thieves. See Ali Baba.

Forum, in English law, a court or judicial tribunal; a place where a trial is held. The name was taken from the Roman Forum and has been retained as a convenient designation in some legal phrases. Thus *lex fori,* in which the term is most generally used, means the law of a place or court where an action is instituted. *Forum contractus* is the court of a place where a contract is made. In various other phrases it has the same general meaning.

Fo'rum, the name given by the Romans to the large public square of a city. Originally the forum was an open space before a public building and was used for markets and a court of justice. While some *fora* were used only for markets, those for courts and public meetings (*fora judicialia*) were never without business annexes, money lenders, especially, having their shops in the abutting buildings or porticoes. Rome during most of the Republic had but one such square, and as 'The Forum' it is still famous for its dramatic part in the history of the city. Later there were several, the first being called *Forum Magnum* (Great) or *Vetus* (Old). It occupied a filled-in swamp comprising about 4½ acres and extending from the foot of the Capitoline Hill to the northeastern part of the Palatine. The central space was long the meeting place of the plebs, *Comitia Tributa;* while the patricians, *Comitia Centuriata,* met on the Comitium adjoining.

In the later Republic, when the aristocracy had lost much of its legal dominance, this division ceased; still later, the 'tribes' and 'centuries' met elsewhere, the Forum being used chiefly for courts and a money exchange. In the centre was a mound or stage called the *rostrum,* because of the ships' beaks placed on its sides in commemoration of some historic conquest; from the rostrum orators made their addresses. During the ascendancy of the aristocrats, the speakers faced the Comitium; in that of the plebs, the Forum. In the Comitium were the Twelve Tables (q. v.) of law, and the Fasti (q. v.)

of court days. Gladiatorial contests and public executions took place there. See ROME.

Forum, The, an American review founded in New York in 1886, for the discussion of social, political, and literary subjects. In 1930 it absorbed the *Century* and changed title to *Forum and Century.*

Forum Appii, ap'i-i, the modern *Foro Appio,* a small place in Latinum, ancient Italy, among the Pontine marshes, situated on the Appian Way (q. v.). It is mentioned in the Acts of the Apostles (xxviii. 15) as a stopping place of Paul on his journey to Rome.

Forum Cornelii. See IMOLA.

Forum Magnum. See FORUM.

Forum Romanum. See FORUM.

For'ward, WALTER (1786–1852), American lawyer and public official, was born in Hartford County, Conn. He removed to Pittsburgh, Pa., in 1803, where he became editor of *The Tree of Liberty,* a Democratic journal. In 1822–5 he was a member of Congress. In 1841 President Harrison made him the first controller of the currency; and the same year he became Secretary of the Treasury in the Cabinet of President Tyler, resigning in 1843. He was later *chargé d'affaires* at Copenhagen (1849–51), and presiding judge of the Allegheny County district court (1851–2).

Foscari, fos'kä-rē, FRANCESCO (*c.* 1370–1457), Venetian doge, was born in Venice. Elected doge in 1423, he speedily concluded an alliance with Florence, Naples, and Savoy, and secured the celebrated Milanese general Carmagnola (q. v.) to lead the allied armies against his former master. After eight years of war Venice gained the towns of Bergamo, Cremona, and Brescia and in later wars large additions of territory in Northern Italy were acquired.

Foscari's latter years were rendered wretched by the intrigues of his enemies against his youngest son GIACOPO, who on five different occasions was examined by the Council of Ten, under torture, in the presence of his unhappy father. At length the Loredani, his hereditary foes, triumphed over Francesco, and procured the old man's expulsion from the dogate (1457).

Foscolo, fos'kō-lō, UGO (1778–1827), Italian poet and patriot, one of the greatest of Italian writers and thinkers, was born in Zante, one of the Ionian Islands. His education was begun in Spalato, and completed in Padua, where Cesarotti inspired him with his love for literature. His first production was a drama, *Tieste* (1797), which won popular favor. From early manhood he strove for the freedom of his country. At first an admirer of Napoleon he afterwards revealed his disapproval of the latter's course in the volume *Lettere di Jacopo Ortis* (1798). Later he was induced to join the French army as a volunteer, and was present at the Battle of the Trebbia and the siege of Genoa. Coming to believe that Napoleon's aims were those of a despot, he left the army, and returned to Milan, where, in 1807, he published his best poem, *I Sepolcri,* a work remarkable for its smooth and polished versification. About this time he also wrote a translation of Sterne's *Sentimental Journey,* and two tragedies, *Ajace* and *Ricciardo,* both showing political tendencies.

In 1809 Foscolo was appointed professor of Italian eloquence at Pavia, where he did splendid work in fostering a love of freedom among his young countrymen, until his chair was suppressed. When the Austrians entered Italy (1813) he was forced to flee, seeking shelter first in Switzerland, and later in England (1816), where he resided till his death. There he wrote *Essays on Petrarch* (1821), *Discorso Storico sul Testo del Decamerone* and *Discorso sul Testo della Commedia di Dante* (1825). See C. Antona-Traversi and A. Ottolini, *Ugo Foscolo,* (4 v. 1928).

Fos'dick, CHARLES AUSTIN (1842–1915), American writer for the young, under the pen name of HARRY CASTLEMON, was born in Randolph, N. Y. He served as a landsman in the Mississippi squadron during the Civil War, rising to be superintendent of coal for the squadron. In 1864 he published *Frank, the Young Naturalist,* which led to a series of books with the same hero. His most popular series were *Gunboat, Rocky Mountain, Sportsman's Club, Frank Nelson, Boy Trapper, Roughing It, Rod and Gun, Go-Ahead, Houseboat, Pony Express,* and *Afloat and Ashore* series.

Fosdick, HARRY EMERSON (1878–), American clergyman, was born in Buffalo, N. Y. He was educated at Colgate University, Hamilton, N. Y., at Union Theological Seminary and Columbia University, New York City. He was ordained as a Baptist minister in 1903 and from 1904 to 1915 was pastor of the First Church of Montclair, N. J. He was instructor in homiletics (1908–15) and from 1915 professor of practical theology at Union Theological Seminary. He served as special preacher at the First Presbyterian Church, New York City, and in 1925 was called as pastor to the Park Avenue Baptist Church, now Riverside Church, N. Y. His published works include *The Second Mile* (1909); *The Manhood of the Master* (1913); *The Assurance of Immortality* (1913); *The Meaning of Faith* (1917); *The Meaning of Service* (1920); *Christianity and Progress* (1922); *Twelve Tests of Character* (1923); *The Modern Use of the Bible* (1924); *A Pilgrimage to Palestine* (1927); *As I See Religion* (1932); *The Hope of the World* (1933); *The Secret of Victorious Living,* and *Twelve Meanings: prayer, faith, service* (1934).

Fosdick, JAMES WILLIAM (1858–), American mural painter, author and lecturer on art, was born in Charlestown, Mass. He studied art in Paris, and executed mural decorations for the Pennsylvania Academy of Fine Arts, the St. Louis Museum, and for many private homes. Among his more important works are: *The Veneration of St. Jeanne d'Arc* (Evans Collection, National Gallery of Fine Arts); *The Field of the Cloth of Gold;* Pentaptych of the life of Jeanne d'Arc in the church of St. Joan of Arc, Jackson Heights, L. I.

Fosdick, RAYMOND BLAINE (1883–), American lawyer and economist, was born in Buffalo, N. Y. He was graduated from Princeton University (1905), and from the New York Law School (1908). He was assistant corporation counsel of New York City (1908–10), and commissioner of accounts, in charge of the investigation of city departments (1910–13). In 1913 he was commissioned by the Rockefeller Bureau of Social Hygiene to visit Europe and study the police organizations there. In 1915–16 he was a member of the New York City Board of Education; special representative of the U. S. War Department in France (1918–19), and undersecretary general of the League of Nations (1919–20). His publications include *European Police Systems* (1915); *Keeping Our Fighters Fit* (1918); *American Police Systems* (1920); *The Old Savage in the New Civilization* (1928); and *Toward Liquor Control* (1933).

Foss, or FOSSE in fortification, is a ditch or moat, either with or without water, immediately without the wall, which offers a serious obstacle to escalading the defences. See FORTIFICATION.

Foss, Cyrus David (1834–1910), American clergyman, was born in Kingston, N. Y. In 1857 he entered the itinerant ministry of the Methodist Episcopal Church, and was pastor of several churches in New York. From 1875 to 1880 he was president of Wesleyan University, when he became a bishop. He visited the missions of his church in Europe (1886), Mexico (1893), India and Malaysia (1897–8). He published: *From the Himalayas to the Equator* (1899); *Religious Certainties* (1905); *Temperance and the Pulpit* (1910).

Foss, Sam Walter (1858–1911), American humorous writer, was born in Candia, N. H. He edited *The Saturday Union* (1883–7) and *The Yankee Blade* (1887–95), and was on the editorial staff of the *Boston Globe* (1889–95). After 1898 he was librarian of the Somerville (Mass.) public library. Many of his poems are in dialect and include: *Back Country Poems* (1894); *Whiffs from Wild Meadows* (1895); *Dreams in Homespun* (1897); *Songs of War and Peace* (1898); *Songs of the Average Man* (1907).

Fos'sa, or Foussa (*Cryptoprocta ferox*), a small savage carnivore peculiar to Madagascar, the largest flesh-eating animal of that island. In structure it is intermediate between the cats and the civets. The total length from the snout to the tip of the long tail is about five feet; the claws are sharp and retractile; the coat short and pale brown in color. It feeds on birds and small animals.

Fossano, fos-sä'no, town and episcopal see, Italy, in the province of Cuneo, 40 miles by rail south of Turin. Features of interest are the fourteenth-century castle, a cathedral, several palaces, an academy of sciences, a seminary and a gymnasium, and remains of old town walls. The houses are built over low arcades under which run the sidewalks, giving the town a gloomy antique appearance. The principal industries are the production of silk, paper, and baskets. Pop. (1931) 21,845.

Fossanuova, Cistercian abbey, Rome province, Italy; 64 m. southeast of Rome, said to be the finest example of Burgundian Early Gothic in Italy.

Fosse. See Foss.

Fossil Ferns. See Fern.

Fossil Footprints. See Ichnology.

Fossil Cycad National Monument, a few miles south of Hot Springs, Fall River county, S. Dakota, is an area of 320 acres containing an unusual display of fossil cycads of the Mesozoic period. These tree ferns are very perfectly preserved and are of intense interest to scientists because their trunks bore flowers when egg-laying monsters were still extant. Some of the tree trunks show nearly 500 buds. The national monument was reserved in 1922.

Fossil Forests, groups of petrified tree-stumps and logs, occurring in sufficient quantities to indicate what were once living forests. They seldom contain standing trees with roots in bedrock. They are not uncommon in the Coal Measures (See Coal; Geology).

The world's oldest known petrified forest is in eastern New York in the Catskills, first noted near Gilboa. These seed fern trees grew to heights of 30 to 40 feet and are said to have flourished during Upper Devonian times, a few hundred million years ago. Stumps were found standing upright with bases resting in and upon shale representing the mud in which the trees grew. Three successive forests flourished here along what was the shore line of a sea; they were submerged, destroyed and buried. See *Annual Report,* Smithsonian Institution (1928).

The greatest known fossil forest has been segregated in Fossil Cycad National Monument (q. v.) in the Black Hills Rim of S. Dakota. These cycads are of tree-fern type and bore flowers, yielding us the first clear glimpses of Mesozoic flowering gymnosperms and the first exposition of the circumstances surrounding the course of change leading to modern flowering plants.

The second largest fossil forest was discovered in 1924 near Cerro Cuadrado volcanic peak, Patagonia. The name *Pararaucaria* is applied to the unique types of these trees, having both bract and scale of *Araucarians* and pines respectively, now extinct in both species. This shows the conifers to be a homogeneous group in their later history.

Near Elk Butte, Stauffer, Oregon, there is a petrified forest noteworthy for its variety, since it has opalized, agatized, jasperized, and cherty specimens together with some that are only partly hardened. A few entire logs of agate are perfect, showing rings of growth and knots, bark and pores. The bark is usually green, but some is jet black agate capable of high polish. The jasperized wood shows every shade and variety of color.

Petrified Forest National Monument, near Adamana, in Arizona, contains three forests of coniferous species of the Triassic period. The area set aside is less than half of the 100 sq. miles of fossil forests in the region, which are eroded deposits of petrified drift logs, or the buried, petrified, and resurrected remains of forests that grew elsewhere. In one forest there are fossil logs of trees which once grew to about 200 feet in height. 'Rainbow Forest' is the name of one part abounding in agate, onyx, and carnelian of intense colors.

Specimen Ridge in Yellowstone National Park has been built up to a height of 2,000 feet above the valley floor by a series of forests entombed in their original upright position by volcanic outbursts. As the softer rock has worn away, petrified trunks of the more recent forests, stripped bare by volcanic matter, have been left standing erect on the hillside. These trees must have originally reached heights of 100 feet or more. Redwoods, pines, laurels, bays, sycamores, and oaks have been identified.

Fossil forests are found at many places, notably at Flora, Miss., near Cairo, Egypt, near Calistoga Hot Springs, California, near Wolverhampton, England, near Glasgow, Scotland, and in Nova Scotia coalfields. See Geology, Fossils, Palaeontology.

Fossil Plants. See Palaeontology.

Fossils, a term derived from Latin *fodere,* to dig up, now restricted to remains and relics of plants and animals which were buried in the earth by natural causes before the Recent (Post Glacial) epoch. Animals with hard limy parts are apt to be better preserved but there have been found durable remains of even the delicate jellyfish.

Fossils are conveniently grouped as follows: (1) fossils actually preserved in ice or frozen soil, in oil, or amber (q. v.); (2) petrified fossils; (3) natural molds; (4) fossil footprints and trails; (5) fossil injectamenta; (6) artificial structures. The first of these include the hairy mammoth and woolly rhinoceros found in ice in Alaska and Siberia as well as insects and spiders found in amber. Petrified fossils are those in which the living matter has been replaced by a mineralizing substance, as is more usual in plants. Natural molds of jellyfish have been found in the lithographic quarries of Bavaria. When buried as soon as cast upon the beach these creatures may leave an enduring cast. Fossil footprints and trails are among the oldest fossils. Fossil rejectamenta give clues to feeding habits

Courtesy Field Museum of Natural History, Chicago

A FOSSIL IS DISCOVERED IN BOLIVIA, SOUTH AMERICA

Excavating the fossil remains of a prehistoric monster which lie buried just beneath the surface.

and internal forms of the animals which made them. Artificial structures include tools of fossil man, fossil worm tubes and cases.

It is essential for fossilization that an organism be buried before extensive disintegration commences. The majority of fossils are of shallow water marine organisms because it is on the Continental Shelf that life teems, organisms struggle and are quickly buried and fossilized in the shifting sediments. Estuarine deposits at the mouths of rivers, river bars and deltas, and the beds of vanished inland seas are apt to contain fossils. Peat swamps, quicksands, coal swamps and asphalt beds contain fewer of them.

Among particularly famous fossil beds are the marine deposits in Solnhofen, Bavaria, which buried and preserved animals of unique scientific value, dragonflies, pterodactyls, jellyfish, birds, cuttle-fish with sepia in their sacs, turtles, the archæopteryx (earliest bird known to history), and the carnivorous dinosaur. Near Harrison, Nebraska, have been found the twin-horned rhinoceros (*Diceratherium*), the clawed ungulate *Moropus,* and the giant swine *Dinohyus.* Further east in Agate Springs Quarry the gazelle camel (*Stenomylus*) has been found. Bone Cabin Quarry near Medicine Bow, Wyoming, now 6,000 ft. above sea level, was once lowlying and water-covered. Fossils of giant dinosaurs have been the most valuable discoveries here.

The study of fossils is known as *palaeontology.* It has been of great importance not only because of the light it throws on the history and development of plant and animal life, but also for the information it gives, as to the age of the beds in which fossils occur, and the conditions under which they were deposited. Palaeontology has done great service to the evolutionary theory by bringing forward instances of the gradual transmutation of one species or genus into another, and the origin of two closely related species from one parent stem by means of a series of gradations, each less and less like the parent form. The study of fossils is of economic importance. In determining the probable yield and consequent values in mining, fossils are studied, as indexes, viz., cretaceous fossils indicate likely coal-bearing strata while coal is never found with Silurian fossils.

Each fossiliferous bed contains characteristic forms or groups of forms that determine the period in which it was mud or sand. From the first two eras of geologic time (Archeozoic and Proterozoic) very few and obscure fossils survive. In the Paleozoic era, sponges, worms, corals, trilobites, etc. are traced. The Ordovician strata show fossils of trilobites and armored fish-like creatures; but graptolites are the most characteristic fossils of the period and include polyps and jellyfish. In the Silurian strata appear the first air-breathing animals of our knowledge. The Devonian Period is called the Age of Fishes because in it they became numerous and differentiated as armored *ostracoderms* and *arthrodires,* ganoid fishes, dipnoans, sharks, some lung-breathing. In the Devonian strata the first record of a terrestrial backboned animal was found—a footprint. Mammals and birds and flowering plants are indicated in the Mesozoic strata, and the rise of mammals in the Cenozoic.

Fossil men have been found chiefly in Europe, but also in China, Java, and South Africa. Of the recorded fossil species of men may be mentioned the apeman, *Pithecanthropus erectus,* of Java (500,000 to 1,000,000 years old); *Homo heidelbergensis* (400,000 years); *Eoanthropus dawsoni* (Piltdown, about 275,000 to 400,000 years); *Sinanthropus pekinensis* (age undetermined); *Homo neanderthalensis* (25,000 to 40,000 B.C.); *Homo rhodesiensis* (not dated).

The fossil horses in our museums show parallel and divergent descent, making the line of evolution very complex.

Consult R. S. Lull, *Fossils* (1931); H. W. Shimer, *An Introduction to the Study of Fossils,* (1933); C. Schuchert, *Textbook of Geology* (Vol. II. 1933); W. A. Ver Wiebe, *Historical Geology* (1934); C. B. Knight, *Before the Dawn of History* (1935).

See Palæontology; Fossil Forests; Ichnology.

Fossombrone, fŏs-sŏm-brō′-nā, tn. and episcopal see, province Pesaro e Urbino, Italy; 16 miles southwest of Fano. It is in the valley of the Metauro, on the ancient Flaminian Way. It has a cathedral, with an altar by Domenico Rosselli. There are mineral springs, and silk and oil industries. Pop. (1931) 10,408.

Foss'way, a Roman military road in Britain. Its probable course was from Seaton (Maridunum), on the Devonshire coast, to Lincoln, thence northward by the High Street to the Humber. In the eleventh century travelers on the four Roman roads, of which Fossway was one, were protected by the 'king's peace.' The Fossway has now almost disappeared.

Foster, Abby Kelley (1811–87), American reformer, was born in Pelham, Mass., of Quaker parentage, and for several years was a teacher in that State. About 1837 she came into prominence as a public speaker on behalf of abolition and for a time suffered indignities and was subjected to harsh treatment. Subsequently she advocated woman suffrage and prohibition; and because denied the right to vote, she refused to pay taxes on her property in Worcester, Mass.

Foster, Benjamin (1852–1926), American painter, was born in North Anson, Me. He studied art in New York City and in Paris. Returning to New York in 1887, he devoted himself to landscape and animal painting. In 1901 he was awarded the Webb Prize for his *Mists of the Morning,* and in 1908 received the gold medal of the National Academy of Design. He was a member of the National Institute of Arts and Letters. Famous paintings by Foster are *Lulled by the Murmuring Stream* (the first American painting after Winslow Homer's to be purchased for the Luxembourg), *Misty Moonlight, October,* and *Summer Moonrise.* His winning the Carnegie Prize in 1906 from the National Academy of Design was his greatest triumph at home.

Foster, Charles (1828–1904), American public official, was born in Ohio in the present Fostoria (named for his father). He was educated at Newark Academy, became a partner in his father's store and later succeeded to the business, which he developed into one of the largest mercantile establishments in Ohio. From 1870 to 1878 he was a member of Congress and as a member of the Ways and Means Committee was instrumental in bringing the Sanborn contract frauds to light. From 1879 to 1884 he was governor of Ohio and from 1891 to 1893 he served as Secretary of the Treasury in Harrison's Cabinet.

Foster, Frank Hugh (1851–1935), American clergyman, was born in Springfield, Mass. He was graduated from Harvard (1873) and from Andover Theological Seminary (1877), and was ordained to the Congregational ministry. He studied at Göttingen and Leipzig, and in 1884–92 was professor of church history at Oberlin, and in 1892–1902 professor of systematic theology, Pacific Seminary, Berkeley, Cal.; from 1907 he was successively professor of history and of philosophy at Olivet College. He was one of the editors of *Bibliotheca Sacra,* and wrote *Seminary Method of Study in the Historical Sciences* (1888);

Courtesy Buffalo Museum of Science, Buffalo, N. Y.

TRILOBITE FOSSILS IN A SLAB OF ROCK

Courtesy Buffalo Museum of Science, Buffalo, N. Y.

MOLD AND CAST OF A FOSSIL TRILOBITE

The trilobites, long extinct, were primitive insect-like creatures which lived on the ocean bottoms of the Paleozoic Era. They were particularly numerous during the Cambrian and Ordovician Periods.

Grotius' Defense (annotated translation, 1889); *Fundamental Ideas of the Roman Catholic Church* (1899); *A Genetic History of the New England Theology* (1907); *Commentator on the Arabic Koran* (1932).

Foster, Sir George Eulas (1847–1931), Canadian public official, born Carleton county, N. B. He studied at the University of New Brunswick and in Edinburgh and Heidelberg. After serving for seven years as professor of classics and history at his alma mater, in 1882 he was elected a member of the Dominion House of Commons, entered Sir John Macdonald's ministry as Minister of Marine and Fisheries in 1885, was Minister of Finance, 1888–96 and leader of the House in 1895–96. In 1903 he went to England on the invitation of Joseph Chamberlain as spokesman for imperial preference. In 1911 he became Minister of Trade and Commerce in Robert L. Borden's Cabinet. He was a member of the Imperial Trade Commission. He was knighted in 1914 and made a member of the Privy Council of 1916. He was one of the four delegates of the British government at the economic conference of the Allies in 1916, and represented Canada at the Peace Conference and at the first assembly of the League of Nations. See his *Memoirs*, edited by W. S. Wallace (1933).

Foster, Henry (1796–1831), English navigator and scientist, made a number of voyages to North and South America. About 1815 he surveyed the mouth of the Columbia River; in 1819–20 visited South America; in 1823–24, journeyed to Greenland and Norway; in 1827 joined Parry (q. v.) in his explorations; and in 1829–31 voyaged to the South Seas, rounded the Cape, and eventually landed at Panama. He was drowned in the Chagres River. His *Narrative* of this voyage was edited by Webster (1834).

Foster, John Gray (1823–74), American military engineer, was born in Whitefield, N. H., and was graduated from West Point (1846). He served in the Mexican War, receiving a brevet as first lieutenant for gallantry at Contreras and Churubusco, and being seriously wounded at the storming of Molino del Rey. After acting as assistant professor of engineering at West Point, he was placed in charge of fortifications in North and South Carolina. At the outbreak of the Civil War he was one of the defenders of Fort Sumter, and after its surrender he commanded a brigade in the expedition to North Carolina, and helped to capture Roanoke Island and Newbern. He was successively in command of the Departments of North Carolina, Virginia and North Carolina, and Ohio, attaining the brevet of major-general in the regular service. After the war he was engaged on important engineering work, including the improvement of Boston Harbor and the construction of fortifications at Portsmouth.

Foster, John Watson (1836–1917), American diplomat and public official, born in Pike county, Ind. He was graduated from Indiana State University (1855), studied at the Harvard Law School, and was admitted to the Indiana bar. During the Civil War he entered the Union Army as major, and for services at Fort Donelson and Shiloh was raised to colonel. In 1865–69 he was editor of the Evansville *Daily Journal*. He entered the diplomatic service, and was Minister to Mexico (1873–80), to Russia (1880–81), and to Spain (1883–85). In 1892–93 he was Secretary of State in President Harrison's Cabinet. He was agent of the United States in the Bering Sea Arbitration at Paris (1893); member of the Anglo-Canadian Commission (1896); U. S. agent in the Alaskan Boundary Tribunal at London (1903); and was plenipotentiary and ambassador on several special missions to foreign countries. On the invitation of the emperor of China he took part in the peace negotiations with Japan, and he represented China at the Second Hague Conference (1907). He published: *A Century of American Diplomacy* (1900); *American Diplomacy in the Orient* (1903); *Arbitration and The Hague Court* (1904); *The Practice of Diplomacy* (1906); *Diplomatic Memoirs* (2 vols., 1909); *War Stories for My Children* (1918).

Foster, John Wells (1815–73), American geologist, was born in Brimfield, Mass. He was graduated from the Wesleyan University (Conn.), and was admitted to the bar at Zanesville, O. In 1837 he was appointed assistant in the geological survey of Ohio, and investigated the coal beds of the State. In 1845 he was commissioned by several mining companies to examine the copper deposits in the Lake Superior region; and in 1847 was appointed by the U. S. Government to assist C. T. Jackson in a geological survey of that region. Subsequently he returned to Massachusetts, and helped to organize the Republican Party there. In 1858 he became professor of natural history in the University of Chicago. He published: *The Mississippi Valley* (1869); *Mineral Wealth and Railroad Development* (1872); *Prehistoric Races of the United States* (1873).

Foster, Judith Ellen (Horton) (1840–1910), American lecturer, born in Lowell, Mass. She removed to Clinton, Ia., where she was admitted to the bar in 1872. She became superintendent of the legislative department of the Woman's Christian Temperance Union; and on the affiliation of that organization with the Prohibition Party, she joined the Non-Partisan Woman's Christian Temperance Union, of which she was elected president. She became well known as a lecturer and campaign speaker.

Foster, Lafayette Sabine (1806–80), American political leader, was born in Franklin, Conn. He was graduated from Brown University (1828), and in 1831 was admitted to the bar. In 1839–40, 1846–49, 1854, and 1870 a member of the State Assembly (speaker in 1847–48 and 1854). From 1855 to 1866 he was a member of the U. S. Senate; was chairman of the Committee on Foreign Affairs during the Civil War; in 1866 was president *pro tem.* of the Senate and acting Vice-President of the United States, and in 1870–76 he served as a judge of the Connecticut Supreme Court. By his will he endowed a professorship of English law at Yale, bequeathed his library to Norwich, and gave his home for a free academy.

Foster, Sir Michael (1836–1907), English physiologist, was born in Huntington. In 1867 he became demonstrator of practical physiology at University College, London, and in 1869 professor. In 1870 he was appointed professor of physiology at Trinity College, Cambridge, and in 1883 at the University of Cambridge, resigning in 1903. He published: *The Elements of Embryology* (with F. M. Balfour, 1874); *Practical Physiology* (with J. N. Langley, 1876); *A Text Book of Physiology* (1877). He was also the joint editor of the *Scientific Memoirs* of Huxley.

Foster, Myles Birket (1825–99), English water-color painter and engraver, was born in North Shields. After a successful career as an engraver he turned to water-color drawing in 1859. Among his best achievements as an engraver were illustrations for Longfellow's *Evangeline* (1850) and for other works of that poet (1852). He also carried out some etchings on steel of his own work, for Milton's *L'Allegro* and *Il Penseroso* (1855), and Gold-

Courtesy the Foster Hall collection, University of Pittsburgh

TITLE PAGE OF THE FIRST EDITION OF STEPHEN FOSTER'S SONG, "JEANIE WITH THE LIGHT BROWN HAIR" (1854)

smith's *Traveller* (1856). As a painter, his rural subjects display much poetic feeling—*e.g., Cows in the Pool, Feeding the Ducks, The Bird's Nest.*

Foster, Randolph Sinks (1820–1903), American clergyman, was born in Williamsburg, O., and received his education at Augusta College, Ky. He became an itinerant Methodist Episcopal preacher in Ohio in 1837 and for the first 13 years of his ministry he preached in Ohio and Virginia. In 1857 he became president of Northwestern University. From 1868–1872 he was associated with Drew Theological Seminary as professor and president, being made a bishop of the M. E. Church in the latter year. He published several religious books.

Foster, Stephen Collins (1826–64), American musical composer and song-writer, was born at Lawrenceville, near Pittsburgh, Pa., and received instruction in vocal and instrumental music at an early age. Several of his most popular songs were composed before he was twenty years old. His 'Old Folks at Home' was published in 1851. About one-quarter of his 125 songs, of which he wrote both words and music, were of the pathetic Negro melody, which Foster did most to develop. After 1860 he lived in New York City. Among his songs 'Nellie Bly,' 'The Old Folks at Home,' 'Old Black Joe,' 'Nelly was a Lady,' 'Massa's in the Cold, Cold Ground,' and 'Come Where My Love Lies Dreaming,' and 'My Old Dog Tray,' may be specially mentioned. Consult M. Foster, *My Brother Stephen* (1932); J. T. Howard, *Stephen Foster, America's Troubadour* (1934).

Foster, Stephen Symonds (1809–81), American Abolitionist and reformer, was born in Canterbury, N. H., and graduated from Dartmouth College in 1838. He studied theology, but the refusal of the authorities of Union Theological Seminary to permit him and his fellow students to hold a meeting to protest against a war with Great Britain over the northwest boundary dispute, led him to abandon the ministry and to attack the church for its attitude toward war and slavery. He was accustomed to attend religious services and create a disturbance by assailing churches and clergymen for their conservative attitude, often provoking mobs and rioting. He also lectured on this subject and in favor of woman suffrage. In 1845 he married Abby Kelley, who was engaged in the same work, and they continued their radical agitation until their deaths.

Foster, Theodosia Toll ('Faye Huntington') (1838– deceased), American author and educator, was born at Verona, N. Y., and graduated (1861) from Oneida Seminary. She was the daughter of Daniel Toll, and was married in 1869 to James H. Foster. Her husband died in 1872, and Mrs. Foster became principal of a school in her native town. Among her numerous books of fiction are *Mr. McKenzie's Answer* (1879), *Mrs. Deane's Way* (1880), *A Modern Exodus* (1897), and *Lewis Elmore—Crusader* (1898).

Fostoria, city, Seneca and Hancock cos., O., 35 m. s. by E. of Toledo, on the L. Erie and W., the B. and O., the N. Y., C. and St. Louis, the Tol. and O. Cent., and the Hock. Val. R. Rs. It is situated in a rich agricultural belt. The chief manufactures are glass, flour, machinery, lumber, barrels, carbon, wire, cultivators, lime, etc. The city possesses a public library. It was settled about 1832 and incorporated in 1858, upon the consolidation of Rome and Risdon as Fostoria. Pop. (1930) 12,790.

Fotheringhay, par. and vil., Northamptonshire, England, on Nen Riv., 9 m. s.w. of Peterborough. Its castle, founded early in the 12th century, was the birthplace of Richard III, and the scene of the imprisonment, trial, and execution of Mary, Queen of Scots in 1587. Only a few fragments of the castle remain.

Foucault, Jean Bernard Léon (1819–68), French physicist; from 1855 held an appointment in the Paris observatory. His first notable achievement was the invention of apparatus for electric lighting, which rapidly came into general use. His researches into the comparative rapidity of light through different media (1850) won him the Copley medal of the Royal Society. In 1851 his proof of the rotation of the earth by means of the pendulum won for Foucault a wide reputation, increased later by his invention of the gyroscope. He was largely responsible for the introduction of physics into the study of astronomy. See *Notice Historique sur la Vie et les Travaux de Léon Foucault,* by J. Lissajous (1875); *Recueil des Travaux Scientifiques de Léon,* ed. by C. Gariel and J. Bertrand (1878).

Foucault Currents are electrical currents induced in a mass of metal when in a magnetic field of varying intensity. See Electricity, Magnetism.

Fouché, Joseph, Duke of Otranto (1759–1820), minister of police under Napoleon, was born in the diocese of Nantes. As a member of the National Convention in 1792, he strongly advocated the execution of the king. In 1794 he put down with great severity (assisted by Collot d'Herbois) the revolt in Lyons, and for this was elected president of the Jacobin Club in Paris. Fouché was appointed minister (or chief) of police (1799), and continued in office under Napoleon, holding in addition the portfolio of minister of the interior. He held the former post for a time under Louis XVIII, but resigned it in 1815, and died in exile at Trieste. If Fouché's career was guided mainly by self-interest, his remarkable tact, foresight, and power of managing men carried France successfully through periods of great internal disturbance. Among Fouché's writings are *Notes aux Ministres Etrangers* (1815), and *Lettre au duc de Wellington* (1817). See N. Forsell, *Fouché, the Man Napoleon Feared* (1928); S. Zweig, *Joseph Fouché* (1930). The *Mémoirs de Fouché* (1824) have been translated into English and though declared spurious by his family, are probably drawn from authentic sources.

Foucquet, Jean (1415–*c.* 1485), French painter, born at Tours: studied in Italy, and settling in Paris (1460), became court painter to Louis XI. He produced some historical works, and painted, among others, a portrait of Charles VII (1461). Though the general level of his work was high, he was most successful as a miniature painter. A French translation of Josephus's *History of the Jews,* in the National Library at Paris, has nine illustrations from his brush; but his best work of this kind was embodied in a breviary for Etienne Chevalier (at Chantilly). Among his other works are illustrations in *Boccaccio* and a *Book of Hours.*

Fougade, or Fougasse (Fr.), a term in fortification meaning a small mine dug deep in the ground and filled with gunpowder, stones, bombs, etc. The fougasse is fired from the surface by fuse or electricity.

Fougères, tn., dep. Ille-et-Vilaine, France, 53 m. by rail E.S.E. of St. Malo. Its castle dates from the 11th century. There are several ancient churches. Shoes, leather dressings, and fabrics are manufactured. Pop. (1931) 21,033.

Foula, isl. Shetland, Scotland, 16 m. s.w. of the Shetland Mainland. Area, about 5 sq. m. Fishing and fish-curing industries are important. It is frequented by

large numbers of gulls and other sea-fowl.

Foulahs. See FULAHS.

Fould, ACHILLE (1800–67), French politician and financier, born at Paris, son of a banker. Entering the Chamber of Deputies in 1842, he attached himself to Guizot; but after the revolution of 1848 was appointed minister of finance, holding the post with one short interval until 1852. Created a senator, on the proclamation of the empire he was appointed minister of state and director of the imperial household. In 1861 he was again finance minister. He originated the *Crédit Mobilier,* and reëstablished his country's credit.

Foulis, ANDREW (1712–75), Scottish printer and art patron. He joined the printing establishment of his elder brother, Robert Foulis (1707–76), who published in 1743 *Demetrius Phalereus de Elocutione,* the first Greek book printed in Glasgow. For thirty years the brothers produced beautiful editions of the classics.

Foulk, GEORGE CLAYTON (1856–93), American naval officer and diplomat, born in Pennsylvania. Having learned Japanese and Korean, he was employed as secretary and naval attaché of the first Korean embassy. At the request of the king he took out American teachers and military instructors to Korea. He married a Japanese lady in 1887, returned to Japan and resigned his commission. He was appointed professor of mathematics at Doshisha University, Kyoto, Japan, where he died.

Foulke, WILLIAM DUDLEY (1848–1935), American lawyer and political economist, born in New York. He graduated from Columbia in 1869 and from the Columbia Law School in 1871. In 1876 he removed to Indiana, was a state senator in 1882–6, president of the Indiana Civil Service Reform Association, and a member of other societies. He was chairman of the Suffrage Congress at the World's Columbian Exposition in 1893, and was U. S. Civil Service Commissioner in 1901–3. He published *Slav or Saxon* (1887, 1889, 1904); *Life of Oliver P. Morton* (1899); *Maya, a Story of Yucatan* (1900); *Protean Papers* (1903); *Songs at Eventide* (1928); *Earth's Generations Pass* (1930).

Foundation for the Promotion of Industrial Peace, an organization incorporated by the U. S. Congress in 1907, in accordance with a plan formulated by President T. Roosevelt. In 1906 the President was awarded one of the Nobel prizes ($40,000) for his efforts to promote the peace of the world, and offered the amount of the prize as a nucleus for a fund to promote peace among the industrial activities of the country.

Foundations, as applied to engineering structures, may be considered the base on which they rest. With the increase in size of bridges, buildings and other structures involving heavy weights to be supported, the foundation design is one of great importance and requires careful work on the part of the engineer and of the contractor. For not only must the weight of a structure be investigated, but also the safe load that a particular type of foundation can safely carry, and the nature of the surrounding soil.

Natural Foundations.— When the structure may be based upon solid rock, the best of all foundations is reached; but in any case the material upon which the foundation rests must have a unit resistance to lateral displacement, disruption, or compression, greater than the load per unit area applied to it by the structure above. In many kinds of clay these qualifications are wanting, though they are sometimes found in deep beds of hard dry clay, and also in compact gravel; though much depends, however, upon what underlies the gravel. Sand, when confined, makes an excellent foundation, but is easily scoured by water and wind, thus tending to undermine the structure.

Concrete Foundations have long been employed for houses, public buildings, and quay walls, resting upon alluvial beds at a moderate depth. Portland cement concrete, poured into the excavation, sets into a monolithic block filling all the inequalities of the natural bed, and distributing the load evenly over a wide area.

Pile Foundations may be selected when the soil can be easily penetrated. Wood piles spaced 3 to 4 ft. apart, depending on the loads to be carried, and of a length depending on the distance to rock or to a firm footing—are driven down by pile drivers. The tops of the piles may be covered with cap timbers, or with concrete, of sufficient strength to carry walls, building columns or other loads. On the silty shores of rivers and estuaries, quay walls have been built on such foundations, which are sometimes protected from the action of the water and silt by sheet piling. Besides wood piles for foundations, are those of concrete. See PILES.

Cofferdams have furnished a means for building of bridge piers in rivers, bays and other bodies of water. They are generally built by driving rows of sheet-piling to form a watertight enclosure, which is pumped dry and the earth excavated to the desired level. In the enclosure, piles may be driven which are used to support the masonry of the bridge piers. The piers of the suspension bridge over the Danube at Budapest may be mentioned as an example of cofferdam and pile construction. Or instead of driving piles, if rock can be reached by excavating in the cofferdam, then concrete is poured directly on the rock, the concrete serving as the base for the masonry pier.

Cylinder Foundations.— The piers of some bridges have been designed of a pair of circular towers, as in the well-known Hawkesbury Bridge in Australia. The substructure is gradually excavated within a steel cylinder, which affords a convenient working chamber for all the operations. The cylinder is open at the bottom, where the excavation is carried on within it, and its base is a sharp cutting edge. The sides of the excavation are always kept up by its vertical walls; and the upper part of the cylinder, surrounded by the water, performs the function of a watertight cofferdam. The top is always above water, being continually built up as the cylinder penetrates to greater depths. The operation of sinking is carried on by one of three methods: (1) With an open top, the interior is kept dry by pumping. This method can be followed in sinking through strata that are impervious to water and fairly solid. (2) In quicksand, loose silt, or porous gravel, the inflow is stopped by establishing hydrostatic equilibrium; the cylinder is kept full of water, and the material excavated by dredging. (3) The equilibrium can be established by pneumatic instead of hydrostatic pressure; the inflow is then just as effectively prevented, and workmen can descend to the bottom, carrying on their work as in the first method. The compressed air is supplied by steam or electric driven air compressors, the pressure being adapted to the hydrostatic head. (See HYDROSTATICS.) The pneumatic cylinder is fitted with an airlock, through which the workmen enter and leave, passing from the atmosphere to the high pressure air in the cylinder. When the cylinder has been sunk to rock or to the desired level it is filled with concrete. In some cases two or more cylinders have been sunk side by side, forming a group of large piles on which the weight

of a masonry structure may be carried.

Caissons are hollow box-like enclosures built of steel or wood. (See CAISSON). The sinking of the caisson is effected by methods which are analogous to those already described for cylinder foundations. The building of the masonry structure is commenced upon the roof of the working chamber before it sinks, and the building is carried up as the sinking proceeds, while excavators are carrying on their work beneath the base of the structure. The compressed air is maintained at a pressure equivalent to the hydrostatic head, and when the chamber sinks to a great depth below the water-surface the pressure becomes high, so high in fact, that it is dangerous to work in them. The East River bridges, New York City, connecting the boroughs of Manhattan and Brooklyn, the Forth Bridge, Philadelphia-Camden Bridge, the deep water quay at Antwerp, and a graving dock at Toulon are among the structures that have caisson foundations. The open top caisson has been preferred for some foundations, as, for example, in the Poughkeepsie, Benares, and Hawkesbury bridges.

The pneumatic process has also been adapted to the building of subaqueous tunnels. Here the operations are greatly helped by stopping the inflow of water and silt by having the internal pneumatic pressure balance the external hydrostatic pressure. At the head of the tunnel shaft is a large cylindrical shield built of steel plates, where the excavating is carried on under compressed air. As the earth, sand and rock are removed from in front of the shield, the shield is pushed forward by hydraulic jacks, and the space behind it lined with cast steel segments which are bolted together and form the tunnel.

Consult E. A. Prentis and L. White, *Underpinning* (1931); S. Baker and A. De Groot, *Foundations* (1932); W. S. Housel, *Practical Method for the Selection of Foundations Based on Fundamental Research in Soil Mechanics* (1929); T. Corkhill, *Brickwork, Concrete and Masonry* (1930–31); G. A. Hool and W. S. Kinne, *Foundations, Abutments and Footings* (1933); H. S. Jacoby and R. P. Davis, *Foundations of Bridges and Buildings* (1933); C. E. Fowler, *Engineering and Building Foundations* (1933).

Founder, or LAMINITIS. See HORSE—*Diseases.*

Founders and Patriots of America, ORDER OF, a national patriotic society formed in 1869; open to any male citizen of the United States lineally descended in the male line of either parent from an ancestor who settled in any of the colonies now included in the United States prior to May 13, 1657, and whose intermediate ancestors adhered to the colonial cause during the Revolution. The object is social, educational, and historical.

Founding. See CASTING.

Foundling Hospitals have for their general object the prevention of infanticide and abortion and of the exposure and abandonment of children. It was not until the Christian Church turned its attention to the matter of caring for them that the preservation of foundlings began to be practiced systematically. Perhaps the earliest instance of provision for abandoned children is the method adopted by the bishop of Trèves in the 6th century, who ordained that any child placed in a marble basin which stood outside the cathedral should be cared for by the church. Mention is made of a foundling hospital there in the 7th century but the first authentic record is at Milan founded by the archpriest Daltheus in 787 A.D. In that year it was decreed by the Council of Nicæa that a foundling hospital should be established in each city. We have certain knowledge of foundling hospitals established at Montpellier (1070), Rome (1198), Einbeck (1200), Florence (1316), Nuremberg (1331), Paris (1362), Vienna (1380). Foundling hospitals in France were especially well organized. At first foundlings in Paris were left on the porch of Nôtre Dame; but in 1536 Marguerite de Valois opened a special home for them; in 1545 Trinity Hospital was opened to them without provision for their maintenance, and in 1552 a sum of money was raised by taxation for their support. It is said that 90 per cent of these children died. Another refuge, the *Couche,* founded by the Bishop of Paris, proved entirely unworthy, children being sold for 20 sous each. At last St. Vincent de Paul in 1638 established a better home, out of which grew the Foundling Hospital of Paris, incorporated in 1670, which absorbed the *Couche* in 1688 and Marguerite de Valois's orphanage in 1772. Any person might leave a child at the Foundling Hospital of Paris without giving any account of it. Paris foundlings were sent with nurses from the hospital after a few days to be boarded in the country at government expense. When the child was 12 years of age he was bound out as an apprentice or became a farm servant, but remained a ward of the State until his 21st year.

During the Middle Ages most of the foundling hospitals had revolving cribs fitted in such a way that half was outside of the building. The baby could be placed without the person bringing it being seen. The disuse of the method was due to its effect on the increase of cases.

In Russia two great foundling hospitals were established in old Moscow and St. Petersburg by Catherine II. In these a mother could reclaim her child up to the age of ten, and might even nurse the infant; the mortality was excessively great.

The care of foundlings in Germany and Great Britain was the work of private philanthropy or under the administration of the poor laws. Christ's Hospital, London, was for a brief time from its establishment in 1553 a foundling hospital. In 1773 Thomas Coran (q. v.) founded the London Foundling Hospital, following the methods of the hospital at Florence. Children under a year old and of good parentage are received on the personal application of the mother who must have been deserted and unmarried. The children are put in the country and brought back to the hospital at the age of six.

In the United States, foundlings are usually taken care of by private institutions. A temporary Home for Deserted Children was established in Boston in 1864 out of which developed the Massachusetts Infant Asylum, incorporated in 1867. Of the infants previously admitted to the almshouses 85 per cent died. In the Infant Asylum the mortality was reduced to 19 per cent. The New York Foundling Asylum was established in 1868 and received 1,399 babes the first year. It was organized by the Sisters of Charity and it early diminished fully 50 per cent infanticide and suspected cases of criminal neglect of infants. The Chicago Foundlings Home was established in 1871.

Foundling hospitals are disappearing in most countries; in the United States the term is no longer common. The hospitals which receive these children usually care for orphans and dependents. The best way to care for foundlings continues to be a disputed question. Hospitals should and generally do endeavor to induce the mother to nurse her infant and they try to keep alive the natural ties between parent and child. See M. Gouroff, *Récherches sur les Enfants-trouvés* (1839); Henderson,

THE FOUNTAIN OF THE GREAT LAKES
By Lorado Taft.
On Michigan Avenue, Chicago

THE BUCKINGHAM FOUNTAIN IN GRANT PARK, CHICAGO

THE LATONA FOUNTAIN OF VERSAILLES, FRANCE

Courtesy of the Chicago Art Institute

Modern Methods of Relief (1905); A. Lallemand, *Histoire des Enfants Abandonnés et Délaissés* (1885).

Fountain, a spring of water furnished with an artificial basin or other structure at the point of emergence. In ancient times fountains were frequently erected in honor of the deity to whom the spring was sacred. Ancient Greece possessed numerous sacred fountains, among others those at Megara, built by Theagenes, those of Pirene and Glauce at Corinth, the fountain Enneacrunus, and that in the temple of Erechtheus (supplied by salt water) at Athens. In Rome fountains were the only source of water supply for the poorer citizens. Examples of medieval fountains are still to be found in various parts of Europe, though, except in Italy, few are of earlier date than 1300. One of the most glaring examples of the time of decadence is seen in the fountain of Limoges, the design of which is as elaborate as it is inartistic. In modern times fountains have become largely ornamental, the chief exception being the drinking-fountain of the streets erected either by philanthropic or municipal enterprise. Of ornamental fountains the most conspicuous examples are those at Versailles. Among the chief are the Basin of Latona or the Frogs, with a group of Latona, Apollo, and Diana executed in white marble; and the Basin of Apollo, adorned with a statue of the god in his chariot, and casting up three jets of water one sixty feet high. In Paris the fountain of earliest date is the Fountain of the Innocents. Of other ornamental fountains the Fontana di Trevi at Rome originally erected (1735–62) by Agrippa but decorated after the design by Niccolo Salvi is more distinguished by size than by any artistic merit. Ornamental fountains have been a prominent feature of various exhibitions, those at Chicago and Buffalo being particularly noteworthy.

Fountains Abbey, ruined abbey. Yorkshire, England, 3 m. s.w. of Ripon. It was founded in 1132 for the Cistercians by Archbishop Thurstan of York. Fountains Hall, dating from the time of James I, is near the W. gate of the abbey.

Fouqué, Friedrich Karl Heinrich de la Motte (1777–1843), German novelist, was descended from an old Huguenot family and was born at Brandenburg. He wrote novels, legends, and plays (the best known being *Sigurd der Schlangentödter*, 1808, a weak handling of the grand Norse theme), and enjoyed great popularity. Very few of his tales are now read, except *Undine* (1811), a graceful fairy tale which shows a curious affinity to the writings of the French symbolists. See L. Jeuthe, *Friedrich de la Motte Fouqué als Erzähler* (1910).

Fouquet, or Foucouet. Nicolas (1615–80), Vicomte de Melun et Vaux and Marquis de Belle-Ile, minister of finance under Louis XIV, born at Paris, and rose to power largely through the influence of Mazarin and of the queen-mother, Anne of Austria. His services during the Fronde were rewarded with the office of *procureur-général* to the Parliament of Paris. In 1652 he became minister of finance. A quarrel with Mazarin and the ill-will of Colbert were, however, followed by the displeasure of the king, who connected the growing deficits in the treasury with the personal extravagance of Fouquet. Arrested in 1661, he was condemned to imprisonment for life in the fortress of Pignerol. See P. Chéruel, *Mémoirs* (1862); M. Boulanger, *Fouquet* (1933).

Fouquier-Tinville, Antoine Quentin (1747–95), public prosecutor during the Reign of Terror, born at Hérouël (Aisne), entered the secret service of the Paris police. At the revolution, through the influence of Danton and Robespierre, he became public prosecutor (1793), and discharged his duties with pitiless rigor, showing himself to be as free from personal bias as he was proof against corruption. Danton and Robespierre were among those whose condemnation he obtained. Imprisoned at last by the National Convention, he himself was condemned to death, after a trial of forty-one days. See *Mémoire pour A. Q. Fouquier* (1794); A. Dunoyer, *The Public Prosecutor of the Terror* (1914).

Fourcroy, Antoine François Comte de (1755–1809), French chemist, born at Paris. In 1784 he became lecturer in chemistry at the college of the Jardin du Roi. He sat as a deputy in the National Convention and the Assembly. As a member of the Committee of Public Instruction, and of the Committee of Public Safety, and, finally, as director-general of public instruction under Napoleon, he did much to further the cause of scientific education in France. Among his works are *Système des Connaissances Chimiques* (1801–02); *Mémoires et Observations de Chimie* (1784); *Philosophie Chimique* (1795); *Notice sur la Vie . . . de Lavoisier* (1796).

Fourier, François Marie Charles (1772–1837), French social philosopher, was born at Besançon. After suffering imprisonment during the Reign of Terror, he began at Lyons to elaborate his schemes for the reorganization of society. These he set forth in his *Théorie des Quatre Mouvements et des Destinées Générales* (anon. 1808), *Traité d'Association Domestique Agricole* (1822; summary in 1823), and *Le Nouveau Monde Industriel et Sociétaire* (1829). It is for his communistic scheme that his name is chiefly remembered. The scheme, in brief, is as follows: Let society be divided into sections (*phalanges*), each including from 1,600 to 1,800 individuals; each *phalange* lodged in a *phalanstère* or common building, surrounded by a square league of arable land, is to be self-governing, though federation between the *phalanges* is optional. The monotony of labor is obviated by alternation of duties; and after payment of a minimum wage to each member, the surplus wealth is divided in shares—five-twelfths being apportioned to labor, four to capital, and three to talent. The privacy of home life may be obtained, but marriage is virtually abolished. Fantastic as his ideas are, they present a certain kinship with modern theories. He has been called the father of coöperation. The experiment made (1832) near Versailles, at the expense of M. Baudet Dulary, failed owing to lack of money. In Fourier's later years his propaganda attracted a small but enthusiastic body of supporters, the chief of whom, Victor Considerant, ably expounded the communistic theory in his *Destinée Sociale* (1834); he also published an *Exposition abrégée du Système de Fourier* (1845). Fourier had followers in the U. S. A., who established a community based on the principles of co-operation. (See Brook Farm.) About thirty-three other similar associations were formed in different parts of the U. S. A. all short-lived. Fourierism has, however, never taken any considerable hold upon socialist thinkers.

Fourier published an attack on two socialist schools—*Pièges et Charlatanisme des deux Sectes, St. Simon et Owen* (1831). See Fourier's *Works* (6 vols. 1840–46, and 1870); *Selections from the Works of Fourier* (Eng. trans. 1901); *Fourier* (extracts from his works collected by E. Poisson, 1932); K. Asch, *Die Lehre Charles Fouriers* (1914); Grabski, *Karol Fourier* (1928); H. Louvancour, *De Henri de St. Simon à Charles Fourier* (1913).

See also J. S. Mill's *Political Economy*.

Fourier, JEAN BAPTISTE JOSEPH, BARON DE (1768-1830), French mathematician, was born at Auxerre. After teaching in the Normal and Polytechnic Schools in Paris, he accompanied (1798) Napoleon to Egypt, where he took an important part in the government of the country, and acted as secretary to the Egyptian Institute. He wrote the historical introduction to the *Description de l'Egypte*, *La Théorie Analytique de la Chaleur* (1822), and other books. A selection of his works appeared as *Œuvres de Fourier* (2 vols. 1889-90). See Champollion-Figeac's *Fourier et Napoléon l'Egypte et les Cent-Jours*.

Fourier Series, infinite series of a special type, named after Fourier, who first showed their importance in his great work on the theory of heat. The series is of the form—

$$a_0 + a_1 \cos\theta + a_2 \cos 2\theta + \ldots + a_n \cos n\theta + \ldots + b_1 \sin\theta + b_2 \sin 2\theta + \ldots + b_n \sin n\theta + \ldots$$

where the coefficients a_1, b_1 are independent of the argument θ. When this series converges to a finite limit, the function represented will be a periodic function going through all its values, as θ increases from any value α to the value $\alpha + \pi$. The investigation of the conditions under which this series is convergent is of high mathematical interest. Physically, the importance of the series lies in the fact that any single valued finite function of θ, with period 2π, can be represented by such a series, and analyzed into component simple harmonic or 'sinusoidal' parts of definite amplitude, and of periods which are as the numbers $1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4} \ldots \frac{1}{n} \ldots$. For example, a violin note of a definite pitch gives rise to vibrations in air which are not of the simple harmonic type which characterizes the vibrations produced by a tuning-fork. The ear recognizes identity of pitch in the two cases, but there is a marked difference of quality. The reason of the fuller quality of the violin note is the presence of sinusoidal vibrations of higher frequency; and the note can be analyzed (as Ohm first pointed out) into a series of simple harmonic tones, related to one another in exactly the same way as the successive terms of a Fourier series. The ear can indeed be trained to effect a partial analysis, and to recognize in the body of tone the component simple harmonic tones which build it up. In the discussion of all complex periodic phenomena, such as tidal flow and ebb, earthquake frequency, diurnal barometric variations, diurnal magnetic variations, penetration of solar heat into the earth's crust, the true mode of attack is along the lines of the Fourier analysis. See FUNCTIONS, PERIODIC.

Fourmies, tn., dep. Nord, France, 46 m. by rail S.E. of Valenciennes. Wool-combing and spinning are of great importance, and the glass works date from about 1600. There are also iron works and foundries. Pop. 13,828.

Fourth Estate, a term applied by Edmund Burke to the public press, in allusion to the three estates of the realm—*viz.* lords, clergy, and commons—which constitute the British Parliament. The expression indicates the great influence of journalism in imperial and domestic affairs.

Foweira, fort on the Somerset or Victoria Nile, 2° 11′ N. and about 32° 20′ E., in the dist. of N. Unyoro, British E. Africa.

Fowke, GERARD (1855–1933), American archæologist, born at Maysville, Ky. Engaged in explorations of aboriginal remains in the eastern part of the U. S. and the valley of the Ohio river in 1885–8 and 1891–3 for the U. S Bureau of Ethnology, of which he was a member for many years. In 1894 and 1896 he investigated the Norse remains in the vicinity of Boston. He also conducted expeditions for the American Museum of Natural History, New York, on Vancouver Island and the lower Amur river in Siberia. In 1902–4 he examined prehistoric remains in Missouri, Kansas, Illinois, and some of the Southern states. He published *Archæological History of Ohio* (1902), besides monographs in the *Reports* of the Bureau of Ethnology, and papers in the archæological journals.

Fowl. See POULTRY.

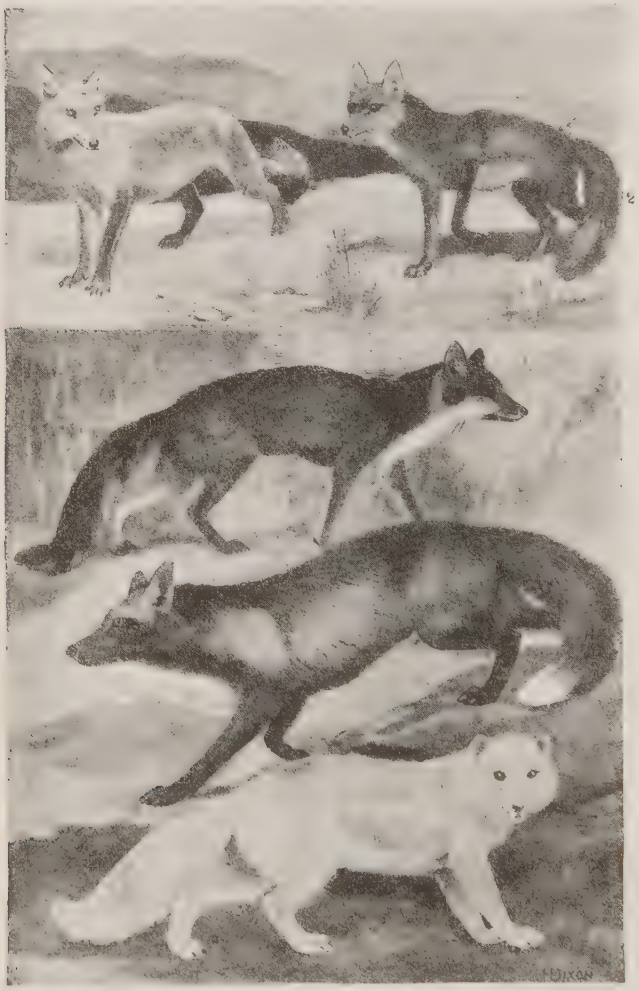
Fowler, CHARLES HENRY (1837–1908), Amer. M. E. bishop, born in Buford, Canada. He graduated at Syracuse University, and in 1859 began the practice of law in Chicago; but after his conversion he graduated at the Garrett Biblical Institute in 1861. He was for 11 years pastor of various churches in Chicago, and in 1872 was elected president of the Northwestern University at Evanston, Ill., which position he resigned upon being appointed editor of the New York *Christian Advocate* in 1876. In 1884 he was elected a bishop. He subsequently visited Japan, Korea, China, Russia, and other countries, organizing the Peking and Nanking universities, and the first M. E. church in St. Petersburg. For eight years he was stationed on the Pacific coast, where he founded the Maclay College of Theology in Southern California. His executive and organizing talents have overshadowed even his popularity as an orator and preacher.

Fowler, ELLEN THORNEYCROFT (*c.* 1873–1929), English novelist, daughter of Henry Hartley, Viscount Fowler, born at Wolverhampton. Her first volume entitled *Verses Grave and Gay* was issued in 1891. As a novelist she attained a high position. Her published works include *Concerning Isabel Carnaby* (1898), *A Double Thread* (1899), *The Farringdons* (1900), *Fuel of Fire* (1902), *Place and Power* (1903), and, with her husband, *Kate of Kate Hall* (1904). Some of these deal with the people of the Midlands. She also published several volumes of verse.

Fowler, FRANK (1852–1910), American painter, born in Brooklyn, N. Y., and studied art with Edward White at Florence, and with Carolus-Duran, and at the Ecole des Beaux Arts in Paris. While in Paris Mr. Fowler assisted Carolus-Duran in painting a ceiling for the palace of the Luxembourg, which was ultimately placed in the Louvre, where it is now to be seen. Returning to New York in 1879, he established his studio in that city and devoted himself to portrait and figure work. He was elected a member of the National Academy in 1899, and received medals for his exhibits at a number of the great expositions. His portraits of distinguished people include those of Samuel J. Tilden, Roswell P. Flower, Madame Modjeska, President Hadley of Yale, William Dean Howells, Archbishop Corrigan, Charles A. Dana, and many officers and professors for the U. S. Military Academy, West Point, N. Y. Among notable decorative pieces is the ceiling, in three panels, representing *Music* and *The Dance*, at the Hotel Waldorf-Astoria in New York. Mr. Fowler prepared several handbooks for art students which have become standard works, including *Drawing in Charcoal and Crayon* (1885), *Oil Painting* (1885), and *Portrait and Figure Painting* (1894).

Fowler, HENRY HARTLEY VISCOUNT (1830–1911), English statesman, entered Parliament in 1880 for Wolverhampton, where he practised as a solicitor, and which he represented for many years. He was under-secretary for the home department in Mr. Gladstone's government (1884–5), and then financial secretary to the Treasury during the last months of the administration (1885-6). On the return of the Liberal party in 1892 he was made President of the Local Government Board, with a seat in the cabinet. In that capacity he carried through the Parish Councils Bill (1893-4)

When Mr. Gladstone retired from public life, Mr. Fowler was transferred to the India Office as Secretary of State. In 1905 he became Chancellor of the Duchy in the Campbell-Bannerman ministry, an office he retained under Mr. Asquith.



Some Foreign Species of Foxes.

1. Egyptian fox. 2. Red fox. 3. Gray fox. 4. Silver fox. 5. Arctic fox.

Fowler, John (1826–64), English inventor of agricultural machines, was born at Melksham, Wiltshire. He achieved his first success in the patenting of a drainage plough, which he used (1850) with good results in the draining of Hainault Forest in Essex. Later, along with Jeremiah Head (1857), he produced a plough driven by a stationary steam-engine by means of ropes.

Fowler, Sir John (1817–98). English civil engineer, was born at Sheffield. He superintended and subsequently managed the Stockton and Hartlepool Railway, and after 1844 was engaged chiefly in building the railway lines afterwards united as the Manchester, Sheffield, and Lincolnshire Railway. The London Metropolitan Underground Railway was his work, including branch lines to the suburbs, etc. The work for which Fowler is best remembered is the construction, in partnership with Sir Benjamin Baker, of the Forth Bridge (1883–90), for which Fowler received a baronetcy. See *Life* by T. Mackay (1900).

Fowler, Lorenzo Niles (1811–1896), American phrenologist, younger brother of Orson Squire Fowler (q.v.), was born at Cohocton, N. Y., and graduated at Amherst. His brother and he established phrenological headquarters in New York city in 1835. Three years afterward they founded the *American Phrenological Journal* at Philadelphia, removing again to New York in 1842. They continued as publishers until 1863. In that year Lorenzo Fowler went to London, and devoted himself to lecturing. He published a *Synopsis of Phrenology and Physiology* (1844), and *Marriage, its History and Philosophy* (1846).

Fowler, Orson Squire (1809–87), American phrenologist, was born in Cohocton, N. Y., and graduated (1834) at Amherst. With his brother, Lorenzo Niles (q.v.), he established a publishing business. Their first book was written in collaboration, and was entitled *Phrenology Proved, Illustrated, and Applied* (1836). Mr. Fowler devoted much time to lecturing on his specialty. He removed to New England in 1863. Some of his books are *Memory and Intellectual Improvement* (1841), *Self-Culture* (1843), and *The Self-Instructor in Phrenology and Physiology*, with his brother (1849).

Fowler, Thomas (1832–1904). English philosophical writer, was born at Burton-Stather in Lincolnshire. From 1873 to 1888 he was professor of logic at Oxford, and president of Corpus Christi College from 1881 to his death. His chief publications are *Elements of Deductive Logic* (1867; 10th ed. 1892); *Elements of Inductive Logic* (1870; 6th ed. 1892); *Locke* (1880), in English Men of Letters Series; *Francis Bacon* (1881), and *Shaftesbury and Hutcheson* (1882), in The English Philosophers Series; *Progressive Morality* (1884; 2d ed. 1895); *Principles of Morals* (1886 and 1887; new ed. 1894), with J. M. Wilson; *Hist. of Corpus Christi College* (Oxford Historical Society, 1893); and popular history of the same in series of *College Histories* (1898). He also edited Bacon's *Novum Organum* (1878; 2d ed. 1898.) and Locke's *Conduct of the Understanding* (1881; 3d ed. 1890).

Fowler's Solution is a one-per-cent. solution of arsenious oxide in potassium carbonate solution, colored with compound tincture of lavender. It is a valuable general tonic.

Fox, a group of animals belonging to the dog family (Canidæ), characterized by their slight

build, long bushy tails, short legs, and usually long ears. The pupil of the eye is elliptical when contracted, and not circular, as in wolves, jackals, and domestic dogs. In habit the foxes are nocturnal and usually solitary. The intelligence and cunning of the foxes has become proverbial, and their senses are remarkably acute. The common fox is *Canis vulpes*, which is widely distributed over Europe, Asia and America, and occurs in a number of color varieties. Among these are several esteemed of great value in the fur trade, as jet black; 'silver,' in which the hairs are black with white tips, giving a frosted appearance; and 'cross,' in which a reddish pelt is marked with blackish stripes along the spine and across the shoulders. Such varieties are rare, and may occur in a litter of normal young. The food consists largely of mice, rats, and even insects and worms, the familiar depredations on poultry yards and game being chiefly committed in spring, when food is required for the numerous cubs; birds of all kinds are, however, keenly appreciated, and the fox will on occasion attack fawns and lambs. It is fond of fruit, a predilection immortalized in the story of the fox and the grapes. The extraordinary cunning displayed by the hunted fox in Britain is probably to be ascribed to the fact that only the most intelligent forms in each generation will live long enough to breed. The scent by means of which foxes are hunted is due to a gland beneath the tail.

Other foxes are the gray fox (*C. virginianus*) of the Southern United States; the small, active kit or swift fox (*C. velox*) of the Plains; the Arctic fox (*C. lagopus*), which in its white or 'blue' winter dress is a valuable fur-animal; the desert fox (*C. leucopus*) of Asia, and the small East Indian fox (*C. bengalensis*). In the case of the Arctic fox, packs are cultivated on islands in the Aleutian archipelago, where they are fed, and a certain number are killed annually for their fur. For the long-eared foxes, see FENNEC. See also FOX-HUNTING.

Fox, Indian tribe. See FOXES.

Fox, AUSTEN G. (1849–1937), American lawyer, born Newport, R. I. Graduated Harvard in 1869, admitted to the bar in 1872, and became vice-president of the Association of the Bar of the city of New York in 1893. He was special assistant district attorney in 1894–6 in the prosecution of police officials after the investigation by the Lexow Committee. In 1897 he was the candidate of the Citizen's Union for district attorney, in 1901 was a member of the Committee of Fifteen, and in 1905 was chairman of the Committee of Nine on the police investigation.

Fox, CAROLINE (1819–71), English diarist, was born at Falmouth. Her life was spent in Cornwall. In her diary, begun in 1835, she records much valuable information regarding Mill, John Sterling, and other leading men with whom she was intimate. See *Memories of Old Friends*, edited by H. N. Pym (1882).

Fox, CHARLES JAMES (1749–1806), English statesman, born in London, was the third son of Henry Fox, first Lord Holland. Having entered Parliament in 1768 as member for Midhurst, Sussex, he supported the proceedings against Wilkes, and was rewarded by being appointed a lord of the Admiralty (1770). He resigned in 1772 to oppose the Royal Marriage Act, an act of independence which the king never forgave. He again took office in 1773 as a junior lord of the Treasury, but in the following year finally separated from the ministry. Henceforth, largely under the influence of Burke, he became the virtual leader of the Whigs, and the active opponent of Lord North's American policy (1774–82), foretelling in the most eloquent language the eventual triumph of the American colonists. In 1780 he was elected member for Westminster, and represented the constituency till the close of his life. He became Secretary of State under Lord Rockingham in 1782. In February, 1783, he formed a coalition ministry with Lord North. The coalition was unpopular, and hated by the king, who, on the defeat of Fox's East India Bill in the House of Lords, dismissed the ministry (1783). In the general election of 1784 his party was utterly routed, and for the next twenty-two years Fox was in opposition. His part in the impeachment of Warren Hastings (1786), his Libel Act of 1791, his support of self-government for Canada (1791), his anxiety to improve the condition of the Irish peasantry, his efforts to obtain the abolition of the slave trade and the repeal of the Test Acts, and his advocacy of parliamentary reform, attest the sincerity of his Liberalism. During the French Revolution he never wavered in his attachment to popular freedom, although it cost him the friendship of Burke (1790), and reduced his party to some forty members. He opposed the war with France (1793), and was on every seasonable occasion the advocate of peace. In 1797 he ceased attending Parliament, and retired to St. Anne's Hill, Thorpe, Surrey, to devote himself to literature, and especially to his *History of England from the Reign of James II.* (unfinished; published in 1808). On Pitt's death (1806) he took office as Secretary of State in the ministry of 'All the Talents,' but died eight months later. Burke calls him 'the most brilliant and accomplished debater that the world ever saw'; and Sir James Mackintosh remarks that 'he certainly possessed, above all moderns, that unison of reason, simplicity, and vehemence which formed the prince of orators.' His sweetness of temper and charm of character were irresistible. See Lord John Russell's *Memorials and Correspondence of C. J. Fox* (1853-7), and *Life and Times of C. J. Fox* (1859-66); Sir George Trevelyan's *Early Hist. of Charles James Fox* (1881); Trotter's *Memoir of the Latter Years of Fox*, and Mr. Lecky's *Hist. of England* (vols. iii.-vi. 1882–7).

Fox, GEORGE (1624–91), founder of the Society of Friends or Quakers, born at Fenny-Drayton in Leicestershire, England. When he reached his nineteenth year he gave himself up to a life of religious meditation and inquiry, wandering from place to place in search of spiritual consolation. In 1648 he began those missionary journeys which practically filled the rest of his life, his object being to preach to all who would hear him the great truth of 'the Light within,' which had brought comfort to his own soul. From this doctrine many others were derived: the disuse of the two outward ordinances of Baptism and the Supper, the discontinuance of a salaried ministry and of the 'anti-Christian yoke of tithes,' and the acceptance in their literal sense of the words of Christ which appear to forbid oaths and war. All these were accepted as testimonies by the sect which was gradually, though almost involuntarily, formed under the preaching of Fox and a band of earnest young men who gathered round him. To this sect the name of 'Quakers' was given in derision by a magistrate at Derby named Gervase Bennet, when Fox called upon him 'to tremble at the name of the Lord.' The refusal of the members of the new sect to doff their hats in token of respect for a superior, and their obstinate adherence to the grammatically correct 'thou' instead of the courtly 'you,' brought them into more trouble.

A great many years of Fox's life were passed in prison. There was one imprisonment at Nottingham of uncertain length, probably in 1649; a second of nearly a year at Derby (1650–51); a third at Carlisle (also of uncertain length) in 1654; a fourth at Launceston, from January to September, 1656.

Soon after the restoration came Fox's fifth imprisonment, at Lancaster (June–October, 1660); and then from 1664 to 1666 an imprisonment at Lancaster and Scarborough, which turned him into a prematurely aged man.

In 1670 he undertook a missionary journey to Jamaica and the American colonies, and shortly after his return (December, 1673) he was once more imprisoned, in Worcester jail, where he remained for fourteen months. In 1677 and in 1684 he visited the Continent, in order to confirm in their faith the large number of adherents who had been attracted by the teaching of Quaker ministers in Holland and N. Germany. He died in London, and was buried in the Friends' usual burying-place at Whitecross Street.

The chief materials for Fox's biography are to be found in his *Journal*, published in 1694 (3 vols.), which, though written by his own hand, received a good deal of editorial care from his disciple, Thomas Ellwood, the friend of Milton, and also from William Penn. His principal writings are contained in *A Collection of . . . . Epistles* (1698) and *Gospel Truth* (1706). The Philadelphia edition of his writings is in eight volumes (1831). See *Lives* of Fox by Marsh (1847), Janney (1853), Watson (1860); Bickley's *Fox and the Early Quakers* (1884); Deacon's *Fox and the Quaker Testimony* (1896); and Evans's *Exposition of the Faith of the Religious Society of Friends* (1828).

Fox, George L. (1825–77), American actor, was born in Boston, Mass., and made his first appearance as a child of five years at the Tremont Theatre in that city. He had already played in New York city when he volunteered for the Civil War. After a few months' service he returned to New York, became manager of the old Bowery Theatre, and subsequently was stage manager of the Olympic Theatre, in the same city, giving there in 1867 the rendering of the clown in the pantomime of *Humpty Dumpty*, with which his name is associated. His last performances were at Booth's Theatre in 1876.

Fox, Gustavus Vasa (1821–83), American naval officer, born at Saugus, Mass. He became a midshipman in the U. S. navy in 1838, took part in the coast survey, served in the Mexican War, and in 1856 resigned with the rank of lieutenant and engaged in the woollen business. Immediately after Pres. Lincoln's inauguration, Fox submitted a plan for relieving Fort Sumter and was sent to interview Major Anderson. He commanded the futile relief expedition which reached Charleston on the morning of April 12, 1861, when the bombardment of Fort Sumter had already begun. In 1861–6 Fox was assistant secretary of the navy, and in this capacity rendered services of great value, 'joining to probity,' says Rhodes, 'executive ability of a very high order.' Moreover, his naval experience and his thorough study of the science of naval warfare enabled him to supply, in the administration of the department, just what his superior, Secretary Welles, lacked. It was Fox who proposed and planned the New Orleans expedition and who chose Farragut for its commander. He was sent to Russia on a special mission in 1866, and took part in the negotiations leading to the purchase of Alaska by the U. S. Subsequently he again engaged in business until his death. See Loubet, *Narrative of Fox's Mission to Russia in* 1866 (1873).

Fox, Henry Richard Vassall, third Baron Holland (1773-1840), English statesman, was born at Winterslow House, Wiltshire. He was much under the influence of his uncle, Charles James Fox, who imparted to him his love of classical literature and his strong Whig principles. He travelled in France, Italy, and Spain, making a special study of Spanish literature. He was appointed in 1806 to negotiate a treaty with the U. S. through the American plenipotentiaries, Monroe and Pinckney. In 1806 he published *The Life and Writings of Lope Felix de Vega Carpio*, and in 1807 *Three Comedies from the Spanish*. In the House of Lords he showed that he had inherited the debating talents of his family. For his views see *The Opinions of Lord Holland, as recorded in the Journals of the House of Lords from* 1797 *to* 1841, by Dr. Moylan (1841). He was Lord Privy Seal in the ministry of 'All the Talents' from the death of Fox to the dismissal of the ministry. On the return of the Whigs to power (1830) he became Chancellor of the Duchy of Lancaster, and, with two short intervals, held the post until his death. In 1796 he began the restoration of Holland House, and here he assembled a brilliant salon of statesmen and men of letters. His son, Henry Edward, fourth Lord Holland (1802-59), edited two of his father's works, *Foreign Reminiscences* (1850) and *Memoirs of the Whig Party During my Time* (1852). See Macaulay's *Essay on Lord Holland* (1848); Brougham's *Statesmen of the Time of George III. and IV.* (1843); and Princess Marie Lichtenstein's *Holland House* (1874).

Fox, John, Jr. (1863–1919), American author, born in Bourbon co., Ky., and graduated (1883) at Harvard. He passed some time in newspaper work and business, finally settling at Big Stone Gap, Va., where the studies of mountain life contained in his novels were made. He published *A Mountain Europa* (1894), *A Cumberland Vendetta* (1895), *Hell for Sartain* (1896), *The Kentuckians* (1897), *Crittenden* (1900), and *The Little Shepherd of Kingdom Come* (1903). *Following the Sun Flag* (1905) is an account of his experiences as a correspondent in the Russo-Japanese War.

Fox, Luke (1586–1634), English navigator, born at Hull. He followed the sea from an early age, and commanded an expedition in search of the northwest passage in 1631. He explored Hudson Strait, the coast of Baffin Land and the territory adjacent on the west, which bears his name, and discovered Fox Channel and Cumberland Island. His map of Arctic regions, which was the best in his time, was published with the account of his explorations bearing the title *Northwest Fox; or, Fox from the Northwest Passage* (1635).

Fox, Margaret (1836–93), American spiritualist, was born at Bath, Canada. She was the daughter of John D. Fox, of Hydeville, N. Y., and at the age of twelve gave spiritualistic manifestations with her younger sister, Katharine. On the family's removal to Rochester, public exhibitions were given under the supervision of committees. The manifestations were repeated in New York city, and much public excitement ensued. Margaret was induced to abandon spiritism by Dr. Elisha Kent Kane, who arranged for her education. On his return from the polar regions in 1855, Margaret claimed to have been married to him, though this was denied by his relatives. She published *The Love Life of Dr. Kane* (1865).

Fox, William Johnson (1786–1864), English preacher, philanthropist, author, and politician, born at Wrentham, Suffolk. Joining the Unitarian Church, he became minister of Parliament Court Chapel (1817), removing with his congregation to Finsbury (1824). He wrote abundantly on moral, social, and political subjects, editing also the *Monthly Repository*, to which Mill, Harriet Martineau, and Robert Browning contributed. Fox devoted his pen and his great rhetorical powers to the cause of reform and to the anti-corn law agitation. He represented Oldham in the House of Commons as an advanced Liberal from 1847 until 1863, with two interruptions. See memoir in *Collected Writings*, vol. xii. (1865-8); also *Hist. of*

the Anti-Corn Law League (1853), by Prentice.

Fox-bat. See FRUIT-BAT.

Fox Channel, the N. part of Hudson Bay, Dominion of Canada; separates Fox Land, the S.W. part of Baffin Land, from Southampton I. and Melville Peninsula. It communicates with the Gulf of Boothia towards the N.W. by Fury and Hecla Strait. It is named from Luke Fox, who explored Hudson Bay in 1631.

Foxe, JOHN (1516–87), English martyrologist, born at Boston, Lincolnshire. For a time he acted as tutor to the son of William Lucy, and after 1548 to the children of Henry Howard, Earl of Surrey, who was executed in 1547. Soon after the accession of Mary, Foxe took refuge on the Continent. The great *Book of Martyrs* was already foreshadowed in a *History of the Christian Persecutions,* begun in Latin at the suggestion of Lady Jane Grey. The first complete edition was published at Basel in 1559. In it was reprinted the plea for toleration addressed by Foxe to the nobles of England in 1556; also treatises on the Eucharist by Hooper, Ridley, Latimer, and Cranmer. Returning to England, Foxe prepared an English edition, which was published in 1563 under the title *Actes and Monuments of these latter and perillous Dayes,* but is generally known under the popular name of *Book of Martyrs.* The frequent errors in the book, only a few of which were corrected by the author, render it untrustworthy as a record of facts. But it stands alone as a powerful and comprehensive history of the martyrs, notwithstanding the great bitterness it shows towards the Roman Catholic party. Among later editions is that of S. R. Cattley (1837–41; improved edition, 1844–9), and that of Dr. Stoughton (1877). Among other works by Foxe is *Christus Triumphans* (ed. R. Day, 1579). See *Memoir* by the Rev. Josiah Pratt, in the Reformation Series of *Church Historians of England* (1870). The Life prefixed to the *Actes and Monuments* (edition 1641) is of uncertain authorship and reliability.

Foxes, N. American Indians, a western branch of the Algonquin family, whose original home was about the headwaters of the Mississippi. But when the kindred Sacs were driven westward by the Iroquois in the 17th century, they were joined in the Green Bay district (Lake Michigan) by the Outtagaumies, as the Foxes called themselves. Later the two confederate and henceforth inseparable nations gained a footing in the Rock River valley, where they long held their ground. In 1900 they numbered 990 in Oklahoma, Iowa, and Kansas.

Foxglove is a name given to the members of the genus Digitalis. The name is a corruption of folks'-glove, which is the term used in a list of plants drawn up in the reign of Edward III. The 'folks' are, of course, the little folks or fairies, who were supposed to hide in the purple bells of the inflorescences. Other names which have, at different times, been given to the plant are 'elves'-gloves' (Welsh), 'bloody-fingers,' 'Our Lady's gloves,' and 'deadmen's bells.' See DIGITALIS.

Foxhound. The foxhound of Great Britain is a dog of pedigree, most kennels having old studbooks, going back, in some instances, a hundred years. The modern foxhound is descended from the old southern hound (the nearest type of which now existing is the bloodhound), but its speed has been accelerated by crossing it with the pointer and by selection so that it has completely lost the loose skin throatiness, and wrinkles of the breed from which it claims descent. Foxhounds are hunted in packs, and are required to give tongue, a mute hound being at once drafted. They vary in size from 22 to 25 in. in height, each pack generally having its own standard. Among the more famous packs, the Belvoir, Pytchley, and Quorn have gained a world-wide reputation. Although not a fast dog in appearance, a foxhound has been known to cover a mile under two minutes, and mighty chases are on record which lasted for nine and ten hours. The young hounds are entered at cub foxes, to train them for their maturer duties. The staghound is a large foxhound, and not a separate variety,

Foxhound.

although from the use to which it has been put and kept it has obtained a distinctive name. See books under DOG.

Fox-hunting. The chase of the fox did not come into general vogue until the middle of the 17th century. It is said that Lord Arundel had a pack of foxhounds which he regularly hunted in 1690 to 1700. The Charlton, afterwards the Goodwood, hounds were also in existence under William III.; and the Staintondale hounds in Yorkshire claim an antiquity of two centuries. Squire Draper in 1726 kept a business-like pack to keep down lamb-killing foxes in Yorkshire, and in 1730 Thomas Fownes kept foxhounds at Stapleton, in Dorsetshire. Lord Wilton, in his *Sports and Pursuits of the English* (1868), says that 'about the year 1750 hounds began to be entered solely for fox.' It was not until the 18th century, however, that fox-hunting as we know it, with its sumptuous expenses, its hard riding, and its refinements came into existence.

In common parlance fox-hunting in England is divided into two parts: the 'shires' and the 'provinces.' Leicestershire, Rutlandshire, and Northamptonshire comprise the former, the rest of England the latter. In the 'shires' are maintained packs of world-wide reputation, such as the Quorn, Pytchley, Belvoir, Cottesmore, and Atherstone. The Duke of Beaufort's hounds at Badminton, dating from 1728, are maintained in great magnificence. The Holderness, Bramham Moor, the Zetland, and the Bedale in Yorkshire; the Fitzwilliam in Lincolnshire; the Meynell in Derbyshire; the Heythrop; the South Berkshire; the Tedworth in Hampshire; the Blackmore Vale in Dorsetshire; and the Dartmoor in Devon are hunts of the highest reputation.

There are many hunt clubs in the U.S., the largest of which is the Meadow Brook, which hunts on Long Island in the spring and fall, although, owing to the absence of foxes, the 'drag' is generally used. Other hunts of considerable prominence are the Myopia, Genesee Valley, Orange County, and Radnor, all of which have anywhere from 20 to 50 couples of hounds, English or American bred.

The Huntsman.—The huntsman, as described by the great sportsman Beckford, should 'have an eye so quick as to perceive which of his hounds carries the scent when all are running, and should have so excellent an ear as to always be able to distinguish the foremost hounds when he does not see them; he should be quiet, patient, and without conceit.' In the field 'he should let his hounds alone while they can hunt, and he should have genius to assist them when they cannot.' In the kennel he must personally supervise everything that tends to the health of the hounds.

The Whipper-in.—The whipper-in must be a loyal and intelligent

support to the huntsman. Thus he must turn hounds on hearing the huntsman's horn, even if he thinks they are right. When trying a cover he lurks in ambush to view the fox breaking away. Towards the conclusion of a run he can be of immense service to the huntsman in checking hounds running back on 'heel' in cover, and in averting them from fresh foxes that they may rouse. When hounds are 'running riot,' or, in other words, following a wrong scent, the whip should get to the ringleader and apply the lash before he commences to rate them.

The Fox.—In England the sport was originally for the purpose of keeping down the foxes, which ravaged the barnyards, but it has long since become a pure sport, and the fox is rarely killed, in some hunts the animal being practically tame, and always allowed to escape to cover.

The writers on hunting admit that scent is a mystery. Lord Coventry lays down the following laws in the *Encyclopædia of Sport* (1897): 'When hounds roll upon the grass, when they eat to either barley meal or meat biscuits.

young horses it is the same. On a road few hounds will hunt the line, and the huntsman must not hurry them.

Hounds.—It was not until the 19th century that a fixed type of foxhound was settled. (See FOXHOUND.) In breeding hounds the litters should be timed to arrive in the months of March and April. Hound shows have greatly improved the breed. The pace that hounds travel at has been the origin of many sporting bets. A hound of Colonel Thornhill's is said to have run four miles in seven minutes and a half.

HOUNDS ASSEMBLED FOR FOX HUNT

In the kennels lies much of the success of the season. The kennels must be dry and well situated. Cold and damp kennels will lame hounds. The floors of the lodging rooms should be sloped on the sides and set with bricks. The sleeping benches should be made to fold up against the wall when the place is cleaned, and should be low, that the tired hounds may reach them easily. The houses for boiling the flesh should be at some distance from the kennels. A constant supply of pure water is a necessity. For food the best oatmeal is superior

grass going to the meet, when they lash their sterns in drawing so as to stain them with blood. when gossamer floats and cobwebs lie on the grass,' the scent will be bad. On the other hand, 'when hounds exhibit unusual keenness on their road to the meet, when they smell strong coming out of kennel, when paving stones sweat, when the barometer rises, when the atmosphere is clear,' these are favorable signs denoting a good scenting day. A windy day is bad for scent. Sheep crossing the line of a fox always cause a check. With

A Drag.—In the absence of foxes a drag is in some districts maintained. Usually a tame fox is kept in a kennel, and his litter, mixed with aniseed, is drawn over the ground in a bag by a hunt servant. The hounds will follow this trail at a surprising pace.

See Beckford's *Thoughts on Hunting* (1899), Vyner's *Notitia Venatica* (1892), 'Nimrod's' (C. Apperley) *Hunting* (1831), *Hunting Reminiscences* (1843), and *Horse and Hound* (1843). But for all details of the modern chase the inquirer will do well to turn to the Duke of Beau-

fort's *Hunting*, in the Badminton Library (1894), and to Lord Coventry's contribution to the *Encyclopædia of Sport* (1897).

Fox Islands, group in Aleutian Islands. Alaska, w. of Unimak Pass.

Fox River. (1.) Or PISHTAKA, river, rises in Wisconsin, and flows s. and s.w. through Illinois to join the Illinois at Ottawa, after a course of 220 m. (2.) Or NEENAH, river of Wisconsin, flows mainly N.E. (through Lake Winnebago in its middle course) into Green Bay, Lake Michigan, after a course of 250 m. By means of a canal, which connects it with the Wisconsin R., it forms a link of navigation between Lake Michigan and the Mississippi.

Fox Shark. See THRESHER.

Foxtail Grass, the popular name of several species of grasses having soft, brushlike spikes of flowers, especially of the genus Alopecurus. The meadow foxtail (*A. pratensis*) is one of the best meadow and pasture grasses.

Fox-terrier, THE. There are two varieties of fox-terrier, the smooth and the wire-haired. Their original duty in life was to bolt foxes when they took to earth; but as hounds were bred lighter and faster, and the general speed of fox-hunting increased, the fox-terrier could not keep up with the chase, and he is now rather a friend and companion than a hunting-field dog. The breed is not an old one, only dating back about a century; but the fox-terrier's cleverness, sharpness, sprightliness, impudence, and pluck endear him wherever he goes. Several special clubs devote their attention to the fos-

Smooth-coated Fox-terrier.

tering of this breed in Great Britain and in the United States, where this is one of the most popular and satisfactory of house-dogs. White, with handsomely disposed markings of either black or light tan, are preferred; and the weight should not exceed 20 pounds for show dogs. See R. Lee's *Fox Terriers* (4th ed., 1901); and books mentioned under DOG.

Foy, MAXIMILIEN SÉBASTIEN (1775-1825), French general, born at Ham, dep. Somme. Imprisoned for his free criticism by the Convention, he was released, to serve with distinction under Moreau, Masséna, and Marmont. After taking part in the defence of the Dardanelles against the British (1807), he served under Junot in Portugal, and commanded a division in Spain, especially distinguishing himself in the retreat into France. Joining Napoleon's army after the latter's escape from Elba, he fought at Quatre Bras and Waterloo. In 1819 he was elected deputy for Aisne, and continued to sit in the Chamber until his death, showing himself a powerful speaker and able champion of Liberal principles. He left unfinished his *Histoire de la Guerre de la Péninsule* (1827). See biography by Tissot subjoined to the above history, and another by Girod de l'Ain (1900).

Foyer, a lobby, especially in a theater or other public building, but also an anteroom or entrance hall to a house. The word is derived from the Latin word, *focarium,* meaning "fireplace," and originally a foyer was the hearth or gathering place and center of the home.

Foyle, LOUGH, the lake-like estuary (15 m. long, average width 7 m.) of the river Foyle, N. coast of Ireland. Glasgow and American mail-ships call at Moville, within the narrow entrance of the lough; smaller vessels proceed to Londonderry.

Fracastoro, GIROLAMO (1483–1553), Italian physician and poet, born at Verona; became professor of logic at Padua, but afterwards practised medicine with great success. He was a singularly accomplished scholar in many branches of knowledge. Among his works are *Syphilis seu Morbus Gallicus* (1530; Eng. trans. 1686), a poem; *De Vini Temperatura* (1534); *De Contagionibus* (1546); and *De Sympathia et Antipathia Rerum* (1546). His *Opera Omnia* appeared at Venice (1555), and his collected poems at Pavia (1718). See *Life* in Italian by Barbarani (1897).

Fraction, in mathematics, is the part of a whole expressed numerically. Let the whole be divided into n equal parts, and let m of these parts be taken together. This quantity, represented by $\frac{m}{n}$ or m/n, is a fraction. If two quantities of the same kind have different magnitudes, the ratio of the smaller to the larger is the fraction which represents the part the smaller is of the larger. When the fraction can be represented by the ratio of two whole numbers, such as 7/22, 113/355, the quantities compared are said to be commensurable. But in many cases the quantities are incommensurable, and cannot be represented in terms of the same unit by two whole numbers, however large. Consequently the fraction cannot be represented as the ratio of two whole numbers. Such quantities are day and month, day and year, month and year; and in expressing the ratio of these numerically, we must be content with approximation. The diameter and circumference of a circle are also incommensurable, and the fraction the former is of the latter is represented by 1 to 3.1415926.... with an infinite number of figures following. Practically we need hardly ever go beyond the sixth significant figure, and to this degree of approximation the ratio may be represented by the finite fraction already given, 113/355.

In adding or subtracting fractions we must reduce them to the same 'name' or 'denominator.' Thus, $\frac{1}{2}+\frac{1}{3}+\frac{1}{6}=\frac{3}{6}+\frac{2}{6}+\frac{1}{6}=1$. When a fraction is expressed as a decimal fraction of more than one figure, we are really dealing with the sum of a series of fractions whose denominators are increasing powers of ten. Thus, $125=\frac{1}{10}+\frac{2}{10^2}+\frac{5}{10^3}=\frac{100}{10^3}+\frac{20}{10^3}+\frac{5}{10^3}$. Hence the fraction means 125 thousandth parts; and each digit has a 'place' value exactly as it has in the number 125. Hence in adding decimal fractions we proceed as in whole numbers, adding together the digits which have the same place.

When the denominator of a fraction reduced to its simplest form contains as a factor any prime number other than 2 or 5, it cannot be expressed finitely as a decimal fraction. Thus, $\frac{1}{3}=.3+\frac{1}{30}=33+\frac{1}{330}=333+\frac{1}{3330}$, and so on. We are dealing, in fact, with an infinite geometrical progression, each term being $\frac{1}{10}$th of its predecessor. Similar results hold for the decimal forms of $\frac{1}{7}$, $\frac{1}{11}$, $\frac{1}{13}$, etc., but generally more complex.

When symbols are used in place of numbers, as in algebra, the conception of the fraction becomes generalized, but the same laws hold. Thus, to add together $\frac{a}{b}+\frac{c}{d}$, we must reduce to the same denominator bd—*viz.* $(ad+cb)/bd$. The ratio of the smaller to the larger of any two quantities of the same kind always gives a fraction, which may be a simple number or a complex number (see COMPLEX NUMBER) according to circumstances. When, however, the quantities are vector quantities, the ratio is the complex number known as the quaternion, which involves four distinct units. See QUATERNIONS.

Frac'ture, in surgery, the term used for separation of the substance of a bone or, more rarely, of a cartilage. The *predisposing* causes which render bones specially liable to fracture may be local—*e.g.* necrosis or tumor affecting a single bone, or general—*e.g.* cancerous cachexia, the diseases called mollities and fragilitas ossium, and old age, all of which render the bones generally less able to bear a strain. The *immediate* cause may be either external violence or muscular action. In the first case the fracture is usually transverse; in the second case, oblique. The chief symptoms are crepitation (except in impacted fractures), pain, swelling, and change in shape or position of the part affected.

In a *simple fracture* the bone is broken completely through, but, as a rule, only at one spot, without any special complication. In a *comminuted fracture* there are several small fragments or splinters. This is more apt to follow a crushing blow than a sudden strain, which is more likely to cause a simple fracture at the weakest point in the bone. *Compound fractures* are distinguished by the protrusion of one or both broken ends through the skin or mucous membrane. There may be comminution as well. *Green-stick fracture* is not a true fracture at all, there being no separation of fragments. It occurs in young children, before ossification is complete. The bone, being still cartilaginous, bends under a stress which would break it were it completely ossified. An *impacted fracture* is one in which the broken extremities are forced into each other.

Treatment.—The first principle is to avoid all risk of rendering a simple fracture compound, by insuring perfect immobility. (For appropriate measures to be taken see FIRST AID).

The object in *setting* a fractured limb is to place the fragments as nearly as possible in their natural relation, and to retain them firmly in this position during healing. The broken limb is extended and molded with the hands. Painful muscular spasms tend to restore the deformity. Their action may be counteracted by the adjustment of some form of *splint* or external rigid apparatus to the limb. Local novocain infiltration serves a similar purpose and permits earlier mobilization.

Fractures of the bones of the head and trunk are dangerous more on account of the risk of laceration of the important organs enclosed by them than because of the injury to the bones themselves.

See COLLES' FRACTURE; FIRST AID; also the articles on the different bones.

Fracture, in mineralogy, denotes the appearance of the broken surface of a mineral. It is distinct from cleavage, which is found only in crystallized substances. When the cleavage is perfect it may be difficult to produce a fracture, as separation will take place most readily along the planes of cleavage. Fracture is defined as smooth, even, uneven, hackly, conchoidal, splintery, etc. *Hackly fracture* is characteristic of metals, such as cast iron or native copper. *Conchoidal fracture* is well seen in flint, which breaks with smooth, rounded, hollow surfaces.

Fra Dia'volo (?1760–1806), the name popularly given to Michele Pezza, a native of Itri, and a celebrated Italian brigand. He served in the Neapolitan and papal forces; entered a monastery, but was expelled; and finally became chief of a band of brigands in Calabria. Entering the service of the Neapolitan Bourbons in 1799, he proved himself a formidable antagonist to the invading French army. In 1806 he attempted to excite Calabria against the French, but was taken prisoner at San Severino, and was executed at Naples. Auber's opera, which bears the name of *Fra Diavolo,* has no real connection with his story. Consult Amante's *Fra Diavolo* (1904).

Fraga'ria is the strawberry genus, a subdivision of the order Rosaceæ. There are about twelve true species, four of which are of garden importance, as being parents of the cultivated varieties. *F. indica* is a pretty greenhouse trailing plant which bears yellow flowers throughout the summer. See STRAWBERRY.

Fra'gonard', JEAN HONORE (1732–1806), French painter and engraver, was born in Grasse, Provence. He studied under Chardin and Boucher; and gained the Prix de Rome in 1752. Proceeding to Italy, he founded his first style on Tiepolo's paintings. After travelling in Southern Italy and Sicily, he painted his *Coresus and Callirrhoë* (Louvre); but finding this classical style unremunerative, he identified himself with the brilliant and audacious phase of amorous and sentimental *genre* art of the Louis Quinze period. On the outbreak of the French Revolution he retired to Grasse. Among his many works are a series of panels—*The Romance of Love* painted for Mme. Du Barry, later purchased by J. P. Morgan and exhibited in the Metropolitan Museum, New York City; *The Swing; The Sleeping Bacchante; The Fountain of Love.* His wife, MARIE ANNE GÉRARD (1745–1823), was a distinguished miniature painter. Their son, ALEXANDER EVARISTE (1780–1850) was a historical painter, sculptor, and lithographer.

Fragonard's chief works are in the Louvre and in the Wallace collection, London. His work is spontaneous and graceful, his color exquisite, his treatment of landscape sympathetic. The De Goncourts consider Fragonard and Watteau to be the only two poet-painters of the eighteenth century. Consult Portalis' *H. Fragonard;* Josz' *Fragonard;* E. and J. De Goncourt's *L'Art du XVIII^e Siècle.*

Fram, three-masted wooden schooner, built in 1892 for Nansen's Arctic expedition; and used also by Captain Amundsen on his Antarctic expedition in 1911. In 1895, under Nansen, the *Fram* reached lat. 85° 57′ N., and in 1911, under Amundsen 78° 34′ S., thus gaining all the distinction of having reached the farthest north and the farthest south of any ship.

The outside planking of the vessel was in three thicknesses, varying from 24 inches up to 28 inches. She was 117 feet long, and had auxiliary engines working a screw propeller, the motive power being supplied by an 80-horse-power Diesel petroleum engine. See ANTARCTIC EXPLORATION; ARCTIC EXPLORATION.

Frambœsia. See YAWS.

Fra'mingham, town, Middlesex county, Massachusetts, on the Sudbury River, and the New York, New Haven and Hartford and the Boston and Albany Railroads; 21 miles s.w. of Boston. It includes the villages of Framingham Centre, Saxonville, Nobscot and Framingham. Framingham Academy, established in 1792, is located here, and is now part of the public school system. The town has also a State normal school—the first in the United States, established at Lexington in 1839.

Framingham is the seat of the chief manufactures, which comprise rubber goods, boots and shoes, boilers, leather goods, and stationers' supplies. Pop. (1920) 17,033; (1930) 22,210.

Fram'lingham, market town, 16 miles northeast of Ipswich, Suffolk, England. The castle, of which ruins remain, was a stronghold of the Howards, dukes of Norfolk; Mary fled there on the death of Edward VI, and proclaimed herself queen. The church contains monuments to the poetic Earl of Surrey, who was beheaded (1547), and to

other members of the Norfolk family. Pop. about 2,400.

Framp'ton, Sir George James (1860–1928), English sculptor. He won the Academy School gold medal in 1887 and studied in Paris under Mercié and Dagnan-Bouveret; exhibited at the Royal Academy in 1894; was elected associate in that year; and gained the grand medal of honor at the Paris Exhibition of 1900. A leader of the 'new movement' in English sculpture in its structural 'polychromatic' and decorative character, his best works are the ivory, bronze, and jewelled *Lamia;* the bronze Mitchell Memorial (Newcastle); the frieze in St. Clement's (Bedford); the Keene Memorial; the *Peter Pan* statue in Kensington Gardens, London; the statue of Edith Cavell; and numerous memorials of Queen Victoria and busts of King George v, and Queen Mary.

Franc, a French coin which has been current at different periods—the earliest having been made in 1360, of gold. The present French franc is a silver coin, dating from 1799. A piece of similar value, and bearing the same name, exists in Belgium and Switzerland; while the various Latin countries have coins corresponding in value, but of different names. The *franc* is divided into 10 *décimes,* each of these being subdivided into 10 *centimes.* The *décime* is little used, but the older *sou,* worth 5 *centimes* is still in common use. With stabilization of the franc on a gold basis in 1928 it consisted of 65½ milligrammes of gold, 900/1,000 fine, but by a decree in 1936 the gold content was fixed between 43 and 49 milligrammes of gold, 900/1,000 fine.

Francavilla-Fontana, fränka-vel'la-fon-ta'na, town and episcopal see, Apulia, Italy, in the province of Lecce; 22 miles s.w. of Brindisi. It manufactures cloth and leather, and has commerce in wine and oil. It contains the well known castle of the Umperiali family. Pop. 17,747.

France, a country of Western Europe, between latitudes 51° 5′ and 42° 20′ N., and longitudes 4° 42′ W. and 7° 39′ E. It is bounded on the north by the English Channel, the Strait of Dover, and the North Sea; on the northeast by Belgium and Luxemburg; on the east, by Germany, Switzerland, and Italy; on the south, by the Mediterranean Sea and Spain; and on the west by the Bay of Biscay, Atlantic Ocean, and English Channel.

The superficial area of France is 212,659 square miles, including the provinces of Alsace and Lorraine (see Alsace-Lorraine) taken by Germany in 1871, but restored to France by the Treaty of Versailles (1919), and the island of Corsica (3,367 square miles).

The continental frontiers of France on the east are quite arbitrary; to the northeast the Vosges and the Jura constitute a natural defense and boundary; while on the southeast and southwest, respectively, the Alps and Pyrenees, both difficult to traverse, form frontiers which are, in the true sense, natural and geographical.

The shores of France are washed by deep seas, with the exception of the Channel, which is of recent formation. The submarine cliffs, a fringe of the continental plateau on which rest both the British Isles and Brittany, approach the coast more and more as we proceed southward, and we reach a depth of 1,650 feet only a few miles out from the Pyrenees. Similarly, on the Mediterranean, except in the bight formed by the Gulf of Lyons, a line of great depth runs close along the coast (1,650 feet, near the islands of Hyères). Thus there are scarcely 220 miles of land between Bordeaux and Narbonne; and this depression, which rises to no more than 625 feet near Naurouse, is marked out by a sequence of water courses. In the same way, by means of the Rhône, the Saône, and the Seine, one may pass from the Channel to the Mediterranean shore; and it is through this waterway, followed by the commerce of the ancients, that civilization has worked northward.

France has a considerable length of coast line in proportion to its superficial area; and of a total frontier of 3,250 miles, 1,760 front the sea. The general shape of the country is hexagonal, and of the six sides three are maritime—*viz.,* the northwest (Channel), the west (Atlantic Ocean), and the southeast (Mediterranean). These coasts assume a widely different physical character, according to the regions of which they form the seaboard. In some parts they are rocky, cut up into islands, peninsulas, and bays, as in Brittany and Cotentin (Normandy), or with shores of high chalk cliffs, as in Caux. In other parts they are low, flat, and sandy, their littoral being bordered with dunes and marshes (*i.e.,* the coasts of Landes and of Bas-Languedoc). Beyond the delta of the Rhône, the Alps and their offshoots extend to the sea, and send out a series of capes and rocky promontories, which leave between themselves and the shore nothing but a narrow 'Riviera,' a characteristic feature of the Mediterranean countries. This Riviera, sunny and smiling, presents the most complete contrast to the Breton coast, which, having defied for centuries the furious attack of the ocean, has gained the appellation of *côte sauvage.* This title is shared by certain islands which have broken away from the continent, and mark the line of the ancient coast—*viz.,* the islands of Yeu, Ré, and Oléron.

Topography.—Looking at a hypsometric map of France, and drawing an imaginary line from Mézières to Bayonne, we are struck by the contrast, as regards contour, presented by the northwest and southeast divisions. On the west there extend the French lowlands, consisting solely of bare plains or *campagnes* and small, wooded clumps, of which no one is higher than 1,650 feet. The highest of these hills, often styled *bocages* (groves), are the Perche, the Bo-

France

cage Normand, the Bocage Poitevin, and the Menez in Brittany. To the east, on the other hand, extend the French highlands, composed either of plateaus and intermittent woodlands—as, for example, the Massif Central (central woodland), the Morvan, and the Vosges—or of mountain chains properly so called—*i.e.*, the Alps, culminating in Mont Blanc (15,781 feet), the Jura, and the Pyrenees. Neglecting the two basins of Paris and Aquitania, which terminate to the east of this line, the low-lying parts are less plains, properly so called, than basins shut in on all sides, as the Limagnes of Auvergne, or natural waterways like the Rhône Valley.

BEAUTIFUL FOUNTAINS AT VERSAILLES

The formation of the French soil is still more complex, for we have, in addition to the foregoing, two distinct zones of mountain folds, differing in age and origin, as follows:

(1) During the Carboniferous epoch a first series of mountain folds (called by geologists the Hercynian chain) was formed. These can be followed from Cornwall to Central Germany. In France its direction was in the first instance from northwest to southeast, this direction being preserved by the heights of Brittany and of Vendée. Toward the center of France an upheaval of the folds took place in the form of a V, and the orientation was changed to southwest and northeast. At the convergence of these two lines of direction there was a line of feebler resistance, along which, by a series of cracks, the volcanic discharges took place which give to Auvergne such a unique physical character (Monts Dômes, Mont Dore, Cantal, Aubrac, and Velay); while in the folds of the chain were formed lagoon and estaurine deposits, which now constitute a continuous series of coal basins. This ancient chain is now broken up and divided into fragments separated by substructural depressions (that of Poitou, the Morvano-Vosgian depression, or that of the Côte d'Or).

(2) On the circumference of this primary France, chains belonging to the great zone of Tertiary mountain folds have arisen at a more recent date. On the one hand, the ancient *massifs*—Massif Central, Beaujolais, and Charolais—were dislocated and broken up; and while certain divisions (Limagnes) subsided, all the eastern fringe was raised to a great height (Cévennes). Then volcanic eruption made a way out of the reopened fissures, and these new bosses, superadded to the primitive plinth, reached a height of 6,095 feet in the Cantal. But, on the other hand, the more recent strata, in working forward, pressed against the ancient *massifs*, and were thus forced to follow their contours. Hence the Alpine arc, as well as its branch, the Jura, was inflected to the northeast.

Finally, in the spaces between the chains and the *massifs*, or in the gulfs which form indentures in them, deposits of marine or lacustrine origin were laid down, forming those basins which are the final physical feature of the actual soil. The Parisian basin, formed of concentric bands, the levelling of which causes a cliff at the outer extremity, presents a perfect type of these basins. This formation of graded shelves does not exist in the basin of Aquitania, which is likewise filled with Tertiary deposits. As for the Rhône Valley, it is a water course which only widens out toward its upper end, or in the plain of the Saône, and along the Mediterranean in Bas-Languedoc.

The principal highlands of France, as has been indicated, are the Central Plateau, the Alps, the Jura, and the Pyrenees. The extensive mass of elevated plains, forming the *Central Plateau,* reach a height of from 3,000 to 4,000 feet in its higher central parts only; several chains, partly of volcanic origin, piled over its surface, attain from 5,000 to 6,000 feet; while the river valleys are dug so deeply into the plateau that it often assumes a hilly aspect. The whole slopes gently towards the northwest gradually melting into the lowlands of the Garonne, the Loire, and the Seine. While sloping gently towards the northwest the plateau has a short steep slope towards the valley of the Rhône and the Mediterranean coast, and the southern part of that slope is fringed by the Cévennes Mountains (chief summit, Mt. Mézenc, 5,754 feet).

Farther north the plateau, which is separated by only the narrow valleys of the Saône and the Doubs from the hills of the Jura, is fringed by the low dome-shaped hills of the Côte-d'Or (2,000 ft.), which connects it with the Vosges. The Vosges, although making a steep descent to the valley of the Rhine, rise but gently over the plateau, their highest points being not more than from 3,300 to 4,000 feet above the sea.

A narrow passage near Belfort (la Trouée de Belfort), utilized by both the canal which connects the Saône with the Rhine and the railroad, which leads from Paris to Switzerland, separates the Vosges from the limestone plateaus of the Jura, part of which belongs to France.

Since the annexation of Savoy in 1860 the *Alps* of Savoy, as well as a portion of the main chain, including the northern slopes of the chain of Mont Blanc belong to France. The pass of Little St. Bernard (7,190) separates the latter from the Graian Alps, which have the two passes of Mont Cenis (6,883) and Mont Genèvre (6,802) leading from France to Italy, and are continued to the southwest by the Oisans group, where immense glaciers rivalling those of Switzerland gather around Mont Pelvoux (13,462). The valley of the Durance separates the Graian Alps from another short parallel chain of the Cottian Alps (Monte Viso, 12,608), while the still lower Maritime Alps descend in terraces to the Mediterranean coast.

The *Pyrenees* extend for a length of 260 miles between the Atlantic Ocean and the Mediterranean Sea. In the east it is built up of three parallel chains

France

running in a northeast direction: the Monts Albères, the Sierra del Cadi, which enters France from Spain and has on French territory the lofty peak Mont Canigou (9,137 feet), and the chain of southeastern Andorra, continued in France by the peaks Puy-de-Carlitte (10,203) and Madres. Farther west the Pyrenees proper consist of at least two parallel chains of the wildest aspect, both running northwest and disposed in *échelons*. Here we find the highest peaks of the Pyrenees: Nethou (11,168) in the Maladetta chain, the Mont Perdu, and several others rising to heights of over 10,000 feet.

Hydrography.—The hydrographic basins are likewise a result of the geological structure, and they in general correspond to the basins above mentioned.

(1) The Seine (480 miles) corresponds to the basin of Paris, the structure of which accounts for the converging direction of the principal tributaries—the Yonne, Marne, and Oise—toward the center of the basin. Its singularly calm and regular course is explained by the moderate rainfall, by the permeability of the soil, and by the gentle slope.

(2) The course of the Loire (620 miles) has been determined by means of heterogeneous elements. Formerly a tributary of the Parisian basin, through the present valley of Loing, it was attracted toward the ocean by an opening in the Armorican *massif*. Its irregular flow, its terrible floods, and the sandbanks which obstruct it make it quite unfit for navigation, and render useless its magnificent network of tributaries, the Allier, Cher, Indre, Vienne, and the Maine with its ramifications.

(3) The Garonne (404 miles) corresponds to the basin of Aquitania. It is also, owing to the clearing of the Pyrenean forests, subject to disastrous floods; while the sediment which it carries away obstructs the passages of the mouth. Its chief tributaries, the Lot, the Tarn, and the Dordogne, take their rise in the Massif Central, and are of little use for purposes of navigation; but the Garonne is navigable as far as Toulouse, whence the Canal du Midi communicates with the Mediterranean.

(4) The Rhône (500 miles) is formed by the union of Alpine rivers (the Rhône of Valais and the Arve), which have summer augmentations, caused by the melting of glaciers, and of a quiet river of the plain—*viz.*, the Saône, which has autumn and winter augmentations, acting as a balance to those of the Alpine rivers. But the torrents in the Cévennes flow down steep slopes, and thus destroy this equilibrium. They have only too frequently been the cause of floods. The Alpine tributaries, Arve Isère, Durance, are enlarged in springtime, when the snow melts; and their size is maintained throughout the summer by the glaciers. The Rhône has by far the greatest volume of French rivers, discharging as much water as all the rest put together; and the problem of its economic utilization is one of the most important in France.

The only lakes of importance are found in the Alps. The largest is Lake Geneva on the Swiss border, belonging in part to Switzerland.

Climate.—In almost its whole extent France is subject to oceanic influences, and has thus a climate of damp warmth. Westerly winds predominate, and give to Brittany 160 to 180 rainy days annually, and 150 even to Paris. These rains are, however, so fine and impalpable that, though they are accompanied by perpetual mists, they give only an annual rainfall of 23.6 inches at Paris. A comparison of isothermal and isocheimal lines demonstrates that the ocean acts more strongly in raising the temperature of winter than in lowering that of summer. At Brest the average temperatures of January and July are 44.6° and 64.4° respectively; at Paris, 35.6° and 66.2°—the difference being due to the greater distance from the ocean. The 'mistral' blows with much constancy and force from the central plateau upon the Mediterranean coast. Though often violent and always chilling, its effect is in the main beneficial. The rainfall is greatest on the coast and in the mountain regions, and least on the northern plains.

Although France, taken all in all, presents a certain uniformity of climate, a definite number of climatic regions may be distinguished which differ in their extremes of temperature, in their variation between these extremes, and also in their annual rainfall. These are exemplified in the climate of (1) Brittany, (2) the Vosges, (3) Paris, (4) the Gironde, (5) Auvergne, (6) Mediterranean coast, (7) the Rhône valley. Two of these climates exhibit special features of difference—*viz.*, that of Brittany, with its lowering sky, continuous clouds, prevailing and persistent mists, and absence of summer; and that of Provence, which enjoys the climate of the Mediterranean, with its bright sky, its cloudless light, its dry and clear atmosphere, and its absence of real winter.

Forests are under the supervision of the Minister of Agriculture. Their area is about 18 per cent of the total surface of the country, and about one-third of them are under public ownership. The principal forests are Ardennes, Compiègne, Fontainebleau, and Orléans, consisting chiefly of oak, beech, elm, and chestnut, and the cork tree in the south.

Mineral Resources and Mining.—The most important mineral products of France are coal and iron, though zinc, lead, copper, manganese, nickel, antimony, aluminum, tungsten, gold, silver, asphalt and sulphur are found. The country is rich also in all kinds of building stone, gravel, chalk, and plaster, while the shales and phosphates are produced on a large scale, and supply agriculture with chemical manure.

Coal and lignite are mined chiefly in the departments of Pas de Calais, Nord, Loire, Gard, Saône-et-Loire, Aveyron, Tarn,

France

Bouches-du-Rhône, Puy-de-Dôme, and Allier. The regaining of Lorraine by the Treaty of Versailles materially increased the French coal resources, the mines of that province having an annual output of at least 4,000,000 tons.

Agriculture has made great strides during the last hundred years. Waste lands, moorlands, commons, and heaths now take up less than 8 per cent of the agricultural soil. Cereals, the vine, beets, potatoes, fruit, and nuts, are cultivated—the two chief products, which have set their mark on the character of the French peasant, being wheat and the vine.

The cultivation of wheat has developed both as regards the superficial area of the land occupied and the yield per acre. The most intensive agriculture is carried on in the basins of the Seine, the Garonne, the upper Saône, and the middle Allier.

The vine, which is replaced in Normandy and Brittany by the apple (for cider), and in the northeast by hops (for beer), was hard hit for some years by the ravages of phylloxera. But the French wine grower has struggled with admirable perseverance against this scourge, and vine growing is again a flourishing industry. The vine flourishes in six departments of the Mediterranean coast (the Midi), which produce more than half of the harvest; the basins of the Garonne and the Charente, in the southwest; the valley of the Rhône, Beaujolais, and Bourgogne in the east; and the region of the middle and lower Loire. Herault leads in both acreage and production; but wine is produced in large quantities in Aude, Gironde, Gard, Pyrenees Orientales, Var, Charente-Inferieure, and Indre-et-Loire.

Silk production is carried on with Government encouragement most extensively in Gard, Drôme, Ardèche and Vaucluse.

Manufactures include textiles, of cotton, silk, linen, and wool, metal works, sugar works, chemical industries, potteries, paper mills, and a great variety of industries connected with furniture, clothing, and the like. The industrial centers are grouped principally around the coal basins, on account of the low price of fuel, or around the seaports, where English coal is landed. The chief groups are those of the north, of Lyonnais, of Paris, and of Nancy.

SPACIOUS COURTYARD AT VERSAILLES

Hundreds of small industries, which occupy two-thirds of the French industrial workers, are especially worthy of note, since in them the artistic taste and inventive genius of the nation are especially apparent. For such small industries Paris is the world's emporium.

Exports were chiefly to the United Kingdom, Belgium, Italy, United States, Switzerland, Spain, Argentina, Germany and Brazil. Imports came from the following countries, in the order of their value: United States, United Kingdom, Germany, Belgium, Italy, Argentina, Brazil, Spain, and Switzerland.

Communications.—As a consequence of its general situation, and of the peculiar arrangement of its valleys, France has always been well equipped with highways of traffic. The great network of Roman roads was completed by Colbert and Napoleon, and is unequalled in the world.

Railways are under State control, and some of them are owned by the government. There are also lines of local interest subventioned by the State or by the departments. All the principal lines start from Paris, and run toward the large towns. There are six great systems, the Northern, the Eastern, the Paris-Lyons-Mediterranean, the Southern, the Paris-Orléans, and the Western.

The waterways have been somewhat neglected in favor of railways. The busiest canals are those of the north, and those which join the north to Paris and the lower Seine, which is itself a highway of active navigation. The port of Paris has a tonnage equal in importance to that of Marseilles.

Government.—*National.*—The French Government has been republican in form since Sept. 4, 1870. Its constitution dates from 1875. The legislative power is vested in a National Assembly, composed of the Chamber of Deputies, elected for four years by direct suffrage, and the Senate, elected by an electoral body composed of (1) delegates chosen by the municipal council of each commune, and (2) deputies, councillors-general, and district councillors of the department. The President, elected for seven years by the National Assembly, and the Ministry constitute the executive power. A special body, introduced by Napoleon I, the *Counseil d'Etat*, presided over by the Minister of Justice, and composed of Councillors, Maîtres de Requêtes, and auditors appointed by the President, advises upon administrative points. The Ministry is selected by the President, chiefly from the National Assembly, although not necessarily so.

Local.—For purposes of local government France is divided into 87 departments and the 3 departments of Algeria. The departments are subdivided into Arrondissements, Cantons, and Communes. A prefect, nominated by the government, is in charge of each department; there are sub-prefects for the arrondissements; the commune is under charge of a municipal council elected by direct suffrage. The canton contains an average of 12 communes; it is the seat of the justice of the peace.

Colonial.—The colonies, politically a part of France, are represented in the Senate by 4 Senators, and in the Chamber of Deputies by 10 Deputies. Those not represented in the National Assembly are for the most part represented in the *Counseil Supérieur des Colonies*, consisting of colonial officials. With the exception of Algiers and Tunis, the colonies are all under the administration of the Minister of the Colonies. See below, section *Colonies*.

Colonies.—The French colonies and dependencies cover an area of about 4,617,579 square

France

miles. Algeria is under the jurisdiction of the Ministry of the Interior, and the Ministry of Foreign Affairs has responsibility for Tunis, Morocco and the Mandated Territories of Syria and Lebanon. The Colonial Ministry supervises the colonies under a governor-general (French West Africa, French Equatorial Africa, Madagascar and Indo-China); the Mandated Territories of Togo and Cameroons; and the Leased Territory of Kwang-Chau-Wan. Under the Ministry of the Colonies are also the colonies with autonomous government, namely Somali Coast, Réunion, French India, St. Pierre and Miquelon, Martinique, Guadeloupe, French Guiana, New Caledonia, New Hebrides, and French Establishments in Oceania.

Population.—Over a superficial area of 212,659 square miles, France possessed (1936) 41,834,923 inhabitants, excluding 107,538 men in the military and naval forces and the crews of the commercial navy abroad. This gave a population to the square mile of 197, a much lower proportion than that of Belgium, the Netherlands, the United Kingdom, Germany, and Italy, but higher than that of Hungary, Spain, Portugal, Denmark, and Russia.

The accompanying table shows the population of the departments at the last two censuses.

The 17 cities, including Paris, the capital, having a population in excess of 100,000 were:

Chief Cities of France

Cities	Pop. 1931	Pop. 1936
Paris	2,891,020	2,829,746
Marseilles	800,881	914,232
Lyons	579,763	570,622
Bordeaux	262,990	258,348
Nice	219,549	241,916
Toulouse	194,564	213,220
Lille	201,568	200,575
Nantes	187,343	195,185
Strasbourg	181,465	193,119
St. Étienne	191,088	190,236
Le Havre	165,076	164,083
Toulon	133,263	150,310
Rouen	122,957	122,832
Nancy	120,578	121,301
Reims	112,820	116,687
Roubaix	117,190	107,105
Clermont-Ferrand	103,143	101,128

Religion.—No religion is officially recognized, the law which went into effect on Dec. 11, 1906, having abolished the Concordat (q. v.) and separated the church from the State. This law, which authorizes all creeds to form associations for public worship, compels them to support themselves and provides for pensioning the clergy as a transitory

Population of France

Departments	1931	1936	Departments	1931	1936
Ain	322,918	316,710	Loiret	342,679	343,865
Aisne	489,368	484,647	Lot	166,637	162,572
Allier	373,924	368,778	Lot-et-Garonne	247,500	252,761
Alpes (Basses-)	87,893	85,090	Lozère	101,849	98,480
Alpes (Hautes-)	87,566	88,210	Maine-et-Loire	475,991	477,690
Alpes-Maritimes	493,376	513,714	Manche	433,473	438,539
Ardèche	282,911	272,698	Marne	412,156	410,238
Ardennes	293,746	288,632	Marne (Haute-)	189,791	188,471
Ariège	161,265	155,134	Mayenne	254,479	251,348
Aube	242,596	239,563	Meurthe-et-Moselle	592,632	576,041
Aude	296,880	285,115	Meuse	215,819	216,934
Aveyron	323,782	314,682	Morbihan	537,528	542,248
Belfort	99,403	99,497	Moselle	693,408	696,246
Bouches-du-Rhône	1,101,672	1,224,802	Nièvre	255,195	249,673
Calvados	401,356	404,901	Nord	2,029,449	2,022,167
Cantal	193,505	190,888	Oise	407,432	402,569
Charente	310,489	309,279	Orne	273,717	269,331
Charente-Inférieure	415,249	419,021	Pas-de-Calais	1,205,191	1,179,467
Cher	293,918	288,695	Puy-de-Dôme	500,590	486,103
Corrèze	264,129	262,770	Pyrénées (Basses-)	422,719	413,411
Corse	297,235	322,854	Pyrénées (Hautes-)	189,993	188,604
Côte-d'Or	333,800	334,386	Pyrénées-Orientales	238,647	233,347
Côtes-du-Nord	539,531	531,840	Rhin (Bas)	688,242	711,830
Creuse	207,882	201,844	Rhin (Haut)	516,726	507,551
Dordogne	383,720	386,963	Rhône	1,046,028	1,028,379
Doubs	305,500	304,812	Saône (Haute-)	219,257	212,829
Drôme	267,080	267,281	Saône-et-Loire	538,741	525,676
Eure	305,788	303,829	Sarthe	384,619	388,519
Eure-et-Loir	254,790	252,690	Savoie	235,544	239,010
Finistère	744,295	756,793	Savoie (Haute-)	252,794	259,961
Gard	406,815	395,299	Seine	4,933,855	4,962,967
Garonne (Haute-)	441,799	458,647	Seine-Inférieure	905,278	915,628
Gers	193,134	192,451	Seine-et-Marne	406,108	409,311
Gironde	852,768	850,567	Seine-et-Oise	1,365,616	1,412,384
Hérault	514,819	502,043	Sèvres (Deux)	308,481	308,841
Ille-et-Vilaine	562,558	565,766	Somme	466,626	467,479
Indre	247,912	245,622	Tarn	302,994	297,871
Indre-et-Loire	335,226	343,276	Tarn-et-Garonne	164,259	164,629
Isère	584,017	572,742	Var	377,104	398,662
Jura	229,109	220,797	Vaucluse	241,689	245,508
Landes	257,186	251,436	Vendée	390,396	389,211
Loir-et-Cher	241,592	240,908	Vienne	303,072	306,820
Loire	664,822	650,226	Vienne (Haute-)	335,873	333,589
Loire (Haute-)	251,608	245,271	Vosges	377,980	376,926
Loire-Inférieure	652,079	659,428	Yonne	275,755	271,685
			Total	41,834,923[1]	41,905,968[1]

[1] Not including military and naval forces and crews of the commercial navy abroad which in 1931 numbered 93,928, and in 1936, 107,538.

measure, and for turning over places of worship and ecclesiastical dwellings to the associations. The law of 1907 makes further provision respecting the surrender of ecclesiastical buildings.

France is divided into 17 archbishoprics—Aix, Albi, Auch, Avignon, Besançon, Bordeaux, Bourges, Cambrai, Chambéry, Lyons, Paris, Rheims, Rennes, Rouen, Sens, Toulouse, and Tours. There are 68 episcopal dioceses, not including Alsace and Lorraine, Algeria or the colonies; in general, they correspond to the departments.

The total Catholic population is placed at 37,000,000. Protestants (the Reformed or Calvinistic Church, and the Lutheran), located mainly in the center and south and in Paris, number about 1,000,000. Jews, located principally in Paris, Bordeaux, and the east, total 68,000. Under the act of July 1, 1901, all religious communities must be authorized by the State and no monastic association can be authorized without a special law.

Education is compulsory and free between the ages of five and thirteen. Primary schools are divided into four classes—*viz.,* infant (for children between the ages of two and six), elementary primary (for children between six and thirteen), higher primary, and primary technical schools. Secondary schools consist of State lycées, communal colleges, and private establishments; the course of study is for seven years. Higher education institutions are special schools and universities, State and private. Teachers' salaries, except in towns of more than 150,000 inhabitants, are paid by the State.

France has an excellent system of agricultural education, centering in the Agronomic Institute, Paris. There are three national schools of agriculture at Grigon, Rennes and Montpellier; a school of horticulture at Versailles; of Colonial Agriculture at Nogent-sur-Marne, and many other schools.

Among the large scientific institutions are the Collège de France, Museum of Natural History, National School of Mines, Agronomic Institute, Ecole Normale Supérieure, Ecole Pratique des Hautes Etudes, Ecole des Chartes, the Institut de France, the highest institution of learning, formed from the five academies—*viz.,* the Académie Française, Académie des Inscriptions et Belles Lettres, Académie des Sciences, Académie des Beaux-Arts, and Académie des Sciences Morales et Politiques. Certain professional and technical instruction is under control of other ministers than the Minister of Public Instruction. Among these are the Conservatoire des Arts et Métiers at Paris, Ecole Centrale des Arts et Manufactures, schools of commerce, agricultural schools, dependent on the Ministry of Agriculture; military schools, under the Ministry of War; naval schools, under the Ministry of Marine; schools of mines, and other similar institutions, dependent on the Ministry of Public Works.

Army and Navy.—The Superior Council of National Defense consists of 13 regular members, civil, military, and naval, presided over by the premier. The Army is under the direction of the Superior Council of War, which, besides the Minister of War (its president), consists of the chief of the general staff, the chief of the army staff, and 12 general officers destined for high commands in war time.

The French army proper in time of peace is stationed in France, Algeria, and Tunis, and is known as the Metropolitan Army; the Colonial Army, made up of white and native troops, is stationed in France and the French colonies.

Military service in the Metropolitan army is compulsory and universal, but liberal exemptions are allowed; liability to service extends from the ages of 21 to 48. Service in the active army is for one and a half years, and in the reserve to complete 28 years. In peace time the Metropolitan army numbers about 447,000. Service in the Colonial Army is by voluntary enlistment and the peace strength is about 190,000.

The *Gendarmerie* is a police force recruited from the army but performing civil duties in time of peace. It includes the *Garde Républicaine* which performs police duty in Paris.

The country is strongly fortified, particularly along its eastern frontier. Verdun and Toul guard the passage between the Ardennes and the Vosges: Belfort holds the Burgundian gate between the Vosges and the Jura; Grenoble commands the Alpine routes from the valley of the Po; and the former German fortresses of Strassburg, Metz and Thionville also lie on the east.

The Navy is under the direction of the Superior Council of the Navy, presided over by the Minister of Marine. It is recruited partly from the army, partly by voluntary enlistment, and partly by conscription from seafaring men between eighteen and fifty years of age. The coasts are divided into five maritime prefectures, each having a fortified port: Cherbourg, L'Orient, Brest, Rochefort, Toulon.

Peoples.—The French people present a certain homogeneous character due to the slow fusion of various races going on since the Stone Ages, when Gaul was a chief center of Palæolithic and Neolithic culture. In remote times the south was occupied by Iberians and Ligurians from North Africa, and all the land north of the Garonne by Celts from Central Europe. These were followed in the historic period by Phœnicians from North Africa; Greeks from Asia Minor; Romans, the great civilizers, from Italy; Teutons (Visigoths, Burgundians, and Franks) from Germany; and Norsemen from Scandinavia—all in the order named.

Apart from a few Basques and Flemings in the extreme south and north, the Celts alone survive as a distinct race in Brittany, where they were reinforced in the fifth century A.D. by their Cymric kinsmen from Britain. All the rest were merged in the Gallo-Roman nationality of pure Neo-Latin speech, with two marked divisions—*langue d'oc* in the south, and *langue d'oïl* north of the Loire.

History.—As early as the sixth century B.C. the colony of Massilia (Marseilles) was founded by Phœnicians, and subsequently peopled by Greeks; and the natives of the interior learned from the newcomers something of the commerce and arts of the more civilized countries of the Mediterranean. The inhabitants, too, of what we should call France were closely akin to those of the Po Valley, and from 218 B.C., when Hannibal crossed Southern Gaul, the relations of the Gauls with Rome were frequent. Eventually Southern Gaul became a Roman province. Hardly had this settlement been achieved when the Gauls and Romans alike were threatened by the Cimbrians and Teutons; but in 102 B.C. Marius completely defeated the invaders at Aix.

In 58 B.C. Cæsar was appointed to the command of the southern province, and was soon drawn by circumstances and his own ambition to interfere in the interior. For again Gaul was threatened by invaders—this time the Helvetians; while on the upper Rhine the Germans, under Ariovistus, were menacing the security of the country. Cæsar forced the Helvetians to retire, and at Vesontio (Besançon) he inflicted an annihilating defeat on the dreaded Germans. Then in a series of campaigns, which are among the most brilliant in history, and are described by

himself with extraordinary lucidity and power, he procured the nominal submission of the whole country. But his absence in Britain allowed the organization of rebellion. The first outburst was crushed; but in 53 B.C., Central and Southern Gaul rose under the able and heroic chieftain Vercingetorix (q.v.) of the Arverni. Cæsar never met a more dangerous antagonist; but in 52 B.C. Vercingetorix was captured in Alesia, and after that the revolt was over.

In the year 180 (which may be taken as marking the end of the tranquil period of the Roman empire) no province stood higher in culture, prosperity, and order than Gaul. But the following centuries were for it, as for the rest of the empire, a time of violent confusion and rapid transition: the two chief forces on which the future of the country depended were the Christian Church and the barbarian invasions. Visigoths and Ostrogoths, Vandals, Burgundians and Lombards, Alemanni, and others passed through the land, and effected settlement, usually of a transitory kind. Constantine and Julian are both closely identified with the province.

In 450 the appearance of Attila at the head of a vast army, chiefly consisting of Huns—compared with whom all other barbarians were civilized—startled the inhabitants of Gaul into temporary union. The Roman Aëtius met the 'scourge of God' at Châlons-sur-Marne with an army of various elements, and, after a desperate contest, practically annihilated the barbarians.

In 476 the Western Empire of Rome ended, and Gaul was forced to work out her own destiny. That destiny was to be largely influenced by the Franks, a people of Germanic stock, who were destined to become the leading military and political agent in the plains of Northern Gaul and to give to France its name and its first dynasty of kings—the Merwings or Merovingians. Early in the fifth century these people were already settled along the central and lower course of the Rhine (the Salians at the mouth of the Rhine, the Ripuarians between the Meuse and the Moselle). Chlodwig (Clovis, Louis) became king of the Salian Franks in 481; and he defeated in turn the Romans (486 A.D.), the Ripuarian Franks, and the Alemanni. But the really decisive event for himself, his dynasty, and his race was not military, but religious. In 496 he accepted Christian baptism at Rheims, at the hands of St. Remigius. Most of the other barbarian races were Arians, and the persistent hostility of the Catholic Church contributed very largely to their overthrow and disappearance. But Chlodwig had the good fortune to join himself to the orthodox church. The union between the French royal house and the papacy all through the Middle Ages was of the closest description, and it is difficult to say which side gained most from the union.

But the dynasty of Chlodwig (the Merwings or the Merovingians) had no organization that could guarantee its stability. Soon we find Gaul, amid great confusion, divided into three main parts. In the south was the Burgundian kingdom; in the north, Austrasia and Neustria. Neustria was the western and more southerly portion, occupying, roughly speaking, the country between the Loire and the Meuse, very largely influenced by Roman culture. Austrasia stretched from the Meuse to the Rhine and beyond; it was thoroughly Germanized; and hostile to the civilization of the west and south. The last half of the sixth and the first part of the seventh century are for the Frankish kingdoms a period of violent confusion. The rivalry of Neustria and Austrasia is reflected in the fierce contest of Brunhilda and Fredegond.

Meanwhile power was slipping from the Merovingian kings. They were, for the most part, weak in body and mind, and their servants and ministers made themselves first independent, then supreme over them. Finally, they deposed the Merovingian kings, and reigned in their stead. These were the mayors of the palace—at first mere court officials, who subsequently held a power something like that of the justiciars in Angevin England. Regularly, for many reigns, the kings reigned and the mayors ruled, until at length the phantom monarchy seemed no longer worth preserving, and the mayors of the palace themselves founded a dynasty, the Carlovingian, that eclipsed the Merovingian.

Pepin, Grimoald, Ebroin are among the most important mayors of the palace. But the great founder of the Carlovingian line was Pepin of Héristal (687–714). He was an Austrasian, but in the Battle of Testry (687) he beat down the rival power of Neustria, and thus established the supremacy of the eastern and less Latinized Franks. He, too, was the first to make real progress in the introduction of Christianity among the Germans across the Rhine. He was succeeded in his mayoral power by Charles Martel (717–741). The latter was (after the Battle of Vincy, 717) mayor of the whole of the Frankish territory, and brought it to a much higher grade of order, discipline, and unity than it had yet attained. But the Frankish power and all Christendom was threatened by the startling advance of the Mohammedan power from Spain. In 732 Charles met them, and in the epoch-making Battle of Poitiers or Tours dealt them a blow from which their power in the west never really recovered.

But this, though the greatest of Charles' exploits, is by no means his only one. He extended the frontier of the Frankish power in the north and east by the conquest of Frisia, Saxony, and Swabia. He coöperated with the papacy and the English monk St. Boniface in spreading and guarding Christianity in Germany. (See CHARLES MARTEL.)

But Charles Martel, strong as he was, did not dare, or did not care, to sweep away the phantom kings—the *rois fainéants*. His successor, Pepin (741–768), did, however, take this inevitable step. In 751 the pope readily gave Pepin permission himself to claim the royal title. King Pepin fully repaid the debt when he entered Italy, broke the Lombard power which was threatening to destroy the independence of the papacy, and granted to the pope territories which formed the beginning of the states of the church (755).

In 768 Pepin's son Charles succeeded to the throne (768–814). Charles the Great or Charlemagne raised to the zenith the power of the Franks in Western Europe, and brought Germany finally into the circle of European civilization. He introduced a far better organization of government than anything the world had known since the fall of the Roman empire—and this is the basis on which most continental states have been built. In fact, he founded the mediæval empire; he fanned the languishing embers of culture and education into a blaze that did not entirely die down at his death. 'With him,' writes a French historian, 'the dissolution of the ancient world ends; with him the construction of the modern world begins.'

On the appeal of the pope Charlemagne conquered Lombardy, and took the title of 'Charles, king of the Franks and Lombards, and patrician of the Romans.' In a long series of campaigns he broke the Saxon power and incorporated it with his dominions. He conquered, in person, or through his generals, Bavaria, the northern Slavs upon

France

the Baltic, the Avars of Hungary, and the Mohammedan dynasty of Spain. On Christmas day 800 he was crowned, in St. Peter's at Rome, by Leo III., and hereafter styles himself 'Emperor of the Holy Roman Empire.' This, the best-known incident of his life, was a step of the most doubtful value; the connection between the empire and Italy proved a danger to both. But it had little influence upon the future history of France.

Although the influence of the great Charles's work was permanent, yet signs of disruption were plentiful during the reign of his successor, Louis the Pious; but on his death, in 840, the tendency became irrepressible. In 843 the treaty of Verdun partitioned the empire of Charles among three claimants. Another Charles was to have the west, which is henceforward properly known as France. Louis took the east, which subsequently grew to be Germany. Between them was erected the middle kingdom of Lotharingia (Lorraine).

The century and a half from 843 to 987 is a period of great obscurity and confusion. The Danes attacked at various points, penetrating up the Loire, the Seine, the Garonne, the Scheldt. The Carlovingian dynasty showed itself nearly as feeble as the old Merovingian, and there were no mayors of the palace to take it into tutelage. Paris was attacked by the Northmen in 885, and though they were driven off from that city, they made themselves masters of many other places, such as Rouen, Bordeaux, and Aix-la-Chapelle. In 912 the treaty of St. Claire-sur-Epte ceded to them Normandy, where their successors were destined to play so great a part. As the power of the monarchy decayed, the feudal powers of the great nobles developed, and the authority of the monarchy became merely nominal. In 987 the most important of these noble families forced itself on to the throne, in the person of Hugh Capet. With him the third French dynasty begins. But for more than a century its fortunes were very obscure; the reigns of Hugh Capet (987–996), Robert II. (996–1031), Henry I. (1031–60), Philip I. (1060–1108) call for no remark here.

With Louis VI. (1108–37) a decided upward movement is perceptible. Despite his unwieldy bulk, he set himself to the task of government with great energy. He enforced good order within his duchy of France, and he united (temporarily) the duchy of Aquitaine to the territories of the crown. But the less striking features of his reign are really the more important: he strengthened the union of the Capetian dynasty with the papacy, and in the throes of its struggle with the empire, and put the monarchy forward as the champion of the weak against the strong—that is to say, of the town folk, peasantry, and clerks against the feudal nobles. The long reign of Louis VII. (1137–80) is comparatively inglorious. He was well served by the Abbot Suger, but his energy was chiefly thrown into the crusades; and he inflicted a really serious blow on the prospects of the French monarchy when he divorced his wife, Eleanor of Aquitaine, and allowed her and her dominions to pass into the hands of Henry II. of England.

But France was saved from the peril by Philip Augustus (1180–1223), who was one of the chief founders of the French monarchy. In 1199 the Angevin power came into the weaker hands of King John; and Philip Augustus, by subtile diplomacy and bold fighting (the battle of Bouvines, 1214), expelled the English king from Brittany, Normandy, Maine, Anjou, Touraine, and most of Poitou. This was the principal event of his reign; but, at the same time, the internal organization of France was rendered more effective by the emancipation of the towns from the feudal yoke, by the better organization of a central administration of law, and by the rapid growth of the University of Paris. Paris became decidedly the most important city in Europe. The policy of Philip was prolonged into the short reign of his successor, Louis VIII. (1223–6), and then came Louis IX. (St. Louis; 1226–70). This reign is the real culmination of the mediæval monarchy of France. Louis was only nine years of age on his accession, and during the first years of his reign France was under the guidance of his mother, Blanche of Castile. Few young women have shown greater powers of statesmanship than she. She beat down the recalcitrant nobility; and in 1229, by the treaty of Meaux, most of the rich country of Languedoc, which had been desolated by the never-ending Albigensian wars, was annexed to the crown of France. Louis himself furnishes one of the instances, rare in history, where the highest qualities of the soldier and statesman are linked with a sensitive conscience, deep piety, and unsullied honor. 'Human virtue,' said Voltaire, 'can attain to no greater height than the character of St. Louis.' He kept a firm hand on the turbulent power of feudalism, and even when the nobles were joined by Henry III. of England, he beat them without difficulty; and his conciliatory and just settlement after the war was even more remarkable than his success as a soldier. His internal reforms were very numerous. The most important was the development of the Parliament of Paris, a great legal corporation, henceforward the chief agent of the crown in combating the nobles. He also prohibited judicial combat, and the right of private war; he systematized the organization of France, both central and provincial. The university of Paris rapidly developed during his reign, and the Sorbonne (the theological faculty of the university) was founded by him; and such great scholars as Roger Bacon and Thomas Aquinas were attracted to Paris and taught there. His relations with the church were naturally cordial throughout; but St. Louis was never weakly compliant to every suggestion that came from Rome. Twice he was induced to embark on the crusading movement. His great crusade took the form of an attack on Egypt, which was at first successful, but in 1250, at the battle of Mansorah, ended in a huge disaster. In 1270 he led an attack against Tunis, and there died of pestilence.

Philip III. ('le Hardi') succeeded (1270–85). The chief event of his reign was the destruction of the French power in Sicily (the sovereignty of which had been given to Charles of Anjou, brother of St. Louis), by the massacre known as the Sicilian Vespers. But when Philip IV. ('le Bel') mounted the throne in 1285, one of the most important reigns in European history commenced. He was the grandson of St. Louis, but there is nothing in Philip that reminds us of the pious king. A ferocious energy and egotism that grew with success are the most obvious features of his character. A close parallel might be drawn between Philip IV. and the English Henry VIII., both as to motives and policy. The chief incident of his early reign was the war with Flanders. In 1300 this rich district was annexed to the French crown; but the exactions of Philip IV's. lawyers — such men as Pierre Flotte and Guillaume de Nogaret — forced Flanders to rebellion in 1302; and then at Courtrai, the Flemings gained an overwhelming victory over the knights of France. The defeat was to some extent avenged at Mons-en-Puelle (1304), but Philip had to accept a treaty whereby all Flanders beyond the Scheldt was abandoned.

Before this war was over, Phil-

Courtesy Railways of France. Photo by le Boyer

A NORMANDY FARMYARD
Showing the rich agricultural life of northern France.

Paul's Photos, Chicago

MARSEILLES, GATEWAY TO THE NEAR EAST
This ancient port has many beauty spots.

ip's quarrel with the papacy had begun. In 1299, the pope by his bull *Clericis Laicos*, had forbidden the laity to exact money from the clergy, but he had yielded to the strong protests of the king of France. After the jubilee of 1300 had given Boniface VIII. a still higher opinion of his powers, the quarrel broke out more fiercely over the question of the comparative powers of pope and king in the management of the church. Bulls and royal edicts answered each other until, in 1303, Boniface excommunicated Philip and accused him of the most deadly heresy. In the same year, Nogaret and Jacopo Colonna, as agents of the king, seized the pope at Anagni, and by violence tried to force him to abdicate. He steadily refused, but died in the same year. Philip then procured the election of Clement V., who was so subservient to the king of France that he not only withdrew his bull of excommunication, but consented to take up his residence at Avignon (1309), which, though papal territory, was really in the power of France. The greatest mark of this victory of royalty over the papacy was Philip's destruction of the order of the Templars (1310). During his struggle with the papacy Philip had relied on the support not only of the Parliament of Paris (which was not a representative body at all) but also of the States-general, now summoned for the first time to represent the three orders of estates of the realm (1302).

Philip's reign seemed to mark the zenith of the royal power, but it was the prelude to a very rapid decline. Philip's three sons, Louis X., Philip V., and Charles IV., reigned in quick succession, and all died without male issue. A disputed succession was the result, for it was maintained that by the Salic Law women in France could not succeed to nor transmit sovereignty. Edward III. of England claimed the throne as son of Isabella, daughter of Philip IV., and thus the Hundred Years' War (1337–1453) began. The English won the battles of Sluys in 1340, Crécy in 1346, Poitiers in 1356, and Najara in 1367, for the feudal levies of France could make little headway against the compact armies of English archers and footmen. Philip VI., with whom begins the Valois dynasty, reigned as the national king from 1328 to 1350, and was succeeded by John II. from 1350 to 1364; but the disasters of the war stirred up a violent revolutionary movement that seemed for a time to destroy the power of the monarchy. The States-general of 1357, under the guidance of Etienne Marcel, claimed the most extensive powers; but the movement was premature, and disappeared finally amidst the utmost violence and tumult. The condition of the country at large, and especially of the peasantry, was deplorable.

Charles V., who reigned from 1364 to 1380, employed companies of mercenary soldiers instead of the old feudal levies, and refused all pitched battles. He was fortunate, too, in finding a commander of genius in Du Guesclin, and by the end of his reign he had worn down the English, reduced their power to very narrow limits, and even retaliated on the coasts of England. Charles VI. (1380–1422) was only twelve years old on the death of his father. In 1392 he became mad, and the exercise of power was disputed between the Orleanists (or Armagnacs) and the Burgundians, with the utmost bitterness and ferocity. It was under such circumstances that Henry V. of England won the battle of Agincourt in 1415; and in 1420, by the treaty of Troyes, it was agreed that he should marry Catherine, the daughter of Charles VI., and inherit the throne of France after the death of her father. The national cause was still maintained south of the Loire by Charles VI.; but it was torn with dissensions, and the outlook seemed hopeless. Then the year 1422 cleared away the two great enemies of France—namely, Henry V. and her own imbecile king.

Charles VII. (1422–61), in whose reign the salvation of France was accomplished, contributed little to it, and is unworthy to have his name associated with it. The quarrel between Burgundy and the monarchy was patched up; the English government was weak and vacillating. Then came that miracle of history, Joan of Arc. The siege of Orleans was relieved in 1429; the illustrious maid was put to death in 1431, and the clouds were still thick round France. But in 1450 the English were driven out of their last stronghold in Normandy; in 1453 the last blow in the war was struck in Castillon, near Bordeaux, and France was mistress within her own boundaries again. In spite of all cross-currents, her destiny ran irresistibly towards a strong monarchy. In 1439 the States-general granted to the monarchy a tax (*Un taille des gens d'armes*) in perpetuity for the maintenance of a standing force: all unwittingly they threw from their hands those very weapons whereby the English Parliament was to win its supremacy. France had suffered terribly during the English wars. It needed a strong will and a not too scrupulous arm to restore order and health to the commonwealth, and in Louis XI. (1461–83) France had both. He crushed the great nobles, strengthened the Parliament of Paris and established provincial parliaments, encouraged industry, welcomed the invention of printing, and did much for art and letters in France. He was hated by the nobles, but was not unpopular with the middle classes and the peasants. But the chief incident of his reign was his long struggle with Charles the Bold, Duke of Burgundy, whose great possessions and claims in Flanders, Brabant, Luxemburg, Lorraine, and in the county and duchy of Burgundy, made him a most dangerous rival to France: he nearly succeeded in re-establishing something like the old kingdom of Lotharingia as it had been defined by the treaty of Verdun. It was the conflict of feudal chivalry in its decadence and modern statesmanship in its embryonic form. A false step on the part of King Louis made him the duke's prisoner at Péronne (1467), but the duke's mistakes and the king's astute and unscrupulous diplomacy gave Louis the victory in the end. The Burgundian power was broken in its attack on the Swiss confederacy, and Charles the Bold was himself killed at Nancy in 1477. Artois and the duchy of Burgundy were permanently annexed to France.

Louis XI. was succeeded by his son, Charles VIII. (1483–98), whose nature, very different from that of his father, was attracted by adventurous and grandiose plans. One solid advantage accrued to France from his reign: by his marriage with Anne of Brittany (1491) that province was annexed to the French crown. But the chief fact of his reign is that he put forward a specious claim to the kingdom of Naples, and in 1494 crossed the Alps to enforce it. This date is often taken as the beginning of modern history; for the French attack on Italy upset the European state-system and brought into existence the idea of 'balance of power,' while it synchronized, or nearly so, with the discovery of the New World, the culmination of the renaissance, and a very marked decline in the authority of the papacy. Charles VIII.'s expedition into Italy was at first brilliantly successful. Naples was reached and occupied; but then the subtle Italians combined against the French king; his conquests were lost, and he escaped with difficulty from Italy.

In 1498 Louis XII. succeeded to the throne. His reign was a successful and prosperous one at home; but his Italian wars were even more dangerous than those

of Charles VIII. He claimed not only Naples but Milan. Milan was occupied in 1500; then Louis XII. made an arrangement with Spain for the partition of Naples (the treaty of Granada). The unfortunate kingdom could not resist the combined attack; but hardly was the conquest made than the victors began quarrelling, and in the war that followed the Spaniards expelled the French (battles of Cerignola and Garigliano, 1503). But Louis XII. was not induced by this mishap to abandon Italian adventure. In 1508 he was a prominent member of the League of Cambrai—an alliance between France, Spain, the papacy, and other powers for the spoliation of Venice. This expedition followed the usual course of French expeditions into Italy. First there was victory; then a rearrangement of alliances; then, in spite of Gaston de Foix's brilliant victory at Ravenna in 1512, defeat, and finally expulsion from Italy (1513). Nor had defeat fallen on France in Italy alone; the Spaniards and English had invaded France and had gained victories. Peace came in 1514, and the king's death in 1515.

His nephew, Francis I. (1515–46), succeeded. France and Spain were already jealous rivals, but in this reign they entered upon a struggle which lasted, as a permanent feature of European war and diplomacy, for nearly two hundred years. Francis was young and ambitious, and at once took up the Italian adventure. He crossed the Alps in 1515, and gained a great victory over the Swiss and Milanese at Marignano. The battle not only raised France and the French king to a great pitch of military glory, but also produced the arrangement with the pope which is known as the Concordat of Bologna, whereby ecclesiastical appointments in France were, in effect, left in the hands of the king. In 1519 the Emperor Maximilian died, and both Francis and the Spanish king, Charles, became candidates for the imperial crown. When Charles was elected as Charles V. (July, 1519), his defeated rival prepared for war against him; and this war, in spite of short truces, is the chief fact of the remainder of the reign. It reached no decisive issue, but inflicted untold misery and injury upon France. In 1523 the Constable Bourbon, the greatest of the French nobles, rebelled and joined the emperor. In 1525 Francis was defeated and taken prisoner in the great battle of Pavia. He was carried as a prisoner to Spain, and at last, in 1526, bought his liberty by signing the humiliating treaty of Madrid. But Francis refused to keep to the terms of the treaty, and the war went on. Twice a peace was arranged (the peace of Cambrai in 1529 and the truce of Nice in 1538). A more important peace was made in 1544 (the peace of Crespy), by which the *status quo* was accepted.

Francis I. died in 1546, and was succeeded by his son, Henry II., and the struggle soon began again. Charles V. attacked Metz in 1552, and his repulse from before its walls was reckoned a deep humiliation for him. Charles abdicated in 1556, and was succeeded (in the Spanish throne, but not in the empire) by Philip II. The French were very sharply defeated at Saint Quentin in 1557, but Francis of Guise, the successful defender of Metz, captured Calais from the English allies of Philip in the following year; and at last the period of the Italian wars was really closed by the peace of Cateau-Cambrésis (1559). France accepted defeat and abandoned Italy; her chief compensation was the recognition of her claim to the three bishoprics (Metz, Toul, and Verdun) upon her eastern frontier. Henry died in the same year.

The reformation now became the chief influence in France, as in other European countries. Francis I. had at first been favorable to the kindred movements of the renaissance and the reformation. But after the battle of Pavia Francis I. sought to conciliate the pope and the church by persecuting Protestantism in its various forms. The same policy was carried on by Henry II. But in spite of all Protestantism grew; it took, not the moderate form of Lutheranism, always ready to cling to the support of the secular powers, but the aggressive and exclusive form of Calvinism. The marked feature of the Protestant movement in France was the very large proportion of nobles who gave their adherence to it—some, like Coligny, attracted by genuine devotion, others welcoming it as a screen for resisting the crown. The Catholics were often militant, and gathered round the family of the Guises—a family of Lorraine origin, but long naturalized in France. The chief members were Francis the duke and Charles the cardinal. The queen-mother, Catherine de' Medici, tried to trim between the two. Her children, the successive kings of France—Francis II. (1559–60), Charles IX. (1560–74), and Henry III. (1574–89)—were of little real influence.

The religious wars, which lasted with little intermission for thirty years, began in 1562. Europe has seen few more destructive struggles. Neither side was strong enough to destroy the other; the Protestants were uniformly unsuccessful in battle, but could still maintain the struggle; then at last the idea of toleration, at first acceptable to neither party, came to the front and triumphed. Between 1562 and 1570 three wars were fought, separated by illusory edicts of toleration. But in 1570 the young king, Charles IX., drew near to Coligny, and an entirely new policy was planned. Protestant and Catholic were to unite in a war against Spain, which was then engaged in an attempt to crush the Netherlands. This was the policy which France finally adopted and which brought her to greatness. But for the present it offended too many interests. The Guises joined with Catherine de' Medici, and determined first to kill Coligny, and afterwards to carry out a general massacre of the Protestants. But this St. Bartholomew massacre (Aug. 24, 1572), though it destroyed many thousands of Protestants, did not annihilate the party, and the war went on.

Charles IX. died in 1574, and was succeeded by his brother, Henry III., but the monarchy lost all control over the country. There were soon three definite parties in France—(1) the Politiques, a new party formed from the old Huguenot party and those Catholics who were willing to accept religious toleration (this party after 1576 recognized the leadership of Henry of Navarre); (2) the Holy League, led by Henry, Duke of Guise, in close alliance with Philip II. of Spain; (3) the Monarchists—those who adhered to the legitimate king, Henry III. The struggle between these three parties is known as the 'war of the three Henrys.' There was the bitterest hatred between Henry III. and Henry of Guise. The king was driven out of Paris by his rebellious subjects in 1588 (the Day of the Barricades), but later in the year he procured the assassination of Duke Henry of Guise and his brother the cardinal. The League now declared its hostility against the king, who was in consequence driven into an alliance with Henry of Navarre. Together they laid siege to Paris in 1589, and seemed on the point of reducing the city by famine when Henry III. was assassinated.

Henry of Navarre was a Protestant; and the League, actively supported by Spain, resisted him vigorously. He made an alliance with Elizabeth of England, and he gained the victories of Arques (1589) and Ivry (1590). He then proceeded somewhat leisurely to the blockade of

Paris; but the siege was raised by the approach of Alexander of Parma, the great Spanish general, from the Netherlands (1591). Again in the next year Henry was foiled by the same antagonist at Rouen. Now Henry, though he could defeat his enemies, could not force them into submission. It was his religion that stood in the way. 'Paris,' he thought, 'was well worth a mass,' and he determined to avow himself a Catholic. The formal change of creed took place in 1593, and before the end of 1594 he was the unrivalled king of France. With him begins the Bourbon dynasty. The war with Spain, however, was still continued, until the treaty of Vervins in 1598 brought it to a temporary cessation. The latter years of the reign were occupied with domestic policy. Sully, his great minister, improved the administration of the finances, encouraged agriculture, and assisted the king in beating down the power of the nobility. But the two most important domestic incidents of the reign were (1) the Edict of Nantes (1598), whereby an unexampled measure of religious toleration was granted to the Huguenots, and (2) the establishment of the Paulette, whereby membership in the judicial bodies called parliaments was made hereditary, on payment of a percentage of income. When he was assassinated in 1610, Henry left only a boy nine years of age to succeed him.

Louis XIII.'s reign lasted from 1610 to 1643, but it was not until the murder of the queen-mother's favorite, D'Ancre, in 1617, that he began really to rule. During nearly the whole of his reign his personal influence was overshadowed by the genius of his great minister Richelieu. The double aim of Richelieu was (1) to centralize and unify all France under the crown, and (2) to establish France as the dominant power in Europe. He pursued both aims with extraordinary tenacity and genius, undeterred by the lukewarm support of the king, the opposition of the royal family, the hatred of the nobles, the suspicions of the Catholic Church, of which he was a cardinal, the armed resistance of the Protestants, and his general unpopularity with the people. In his foreign policy he had to fight against the allied and kindred houses of Spain and Austria. At first he interfered in Germany only incidentally, as, for instance, by the support he gave to Gustavus Adolphus; but after the death of the Swedish king, France had to take the arena as an avowed combatant (1635). She suffered many reverses, for her armies were unused to the later developments of military science, but before the end of the reign the fortune of war was already turning strongly in her favor (Breisach, taken 1638; Turin, taken 1640; the Spanish navy crushed, 1639; Portugal declared independent of Spain, 1640). In his domestic policy Richelieu crushed the separate political existence of the Protestants by the capture of Rochelle (1627), but showed no desire to destroy the religious toleration that had been granted by the Edict of Nantes. He had continually to watch the plots of the French nobles, who were led by the king's brother, Gaston of Orleans; and though he often seemed likely to be overthrown, he was triumphant in the end. In 1632 Montmorency was killed in the battle of Castelnaudary, and Cinq Mars and De Thou paid for their plots with their heads in 1642. The same policy underlies Richelieu's attacks on the parliaments of Paris and other cities for the representative assemblies of the provinces, his destruction of the nobles' castles, and his establishment of provincial intendants (royal officers for the control of the provinces who are henceforth of the first importance for the general government of the country). The age of Louis XIV. was largely the result of his action.

The reign of Louis XIV. is the longest in France, and perhaps in European history (1643–1715), but it was not until 1661 that the king began really to govern. The first eighteen years of his reign saw the government of the queen-mother and her minister Mazarin. This period was, in foreign policy, a continuation of the action of Richelieu; but meantime the internal politics of France fell into confusion and civil war, from want of a strong hand and will. As a result of the action of Richelieu, France was engaged in practically two wars. In Germany, in close alliance with the Protestant powers of Europe, she was fighting against the power of Austria, while at almost every point of her frontiers she had to resist the designs (military and diplomatic) of Spain. In both wars Mazarin reaped what Richelieu had sown. The French armies were well disciplined and admirably led by Condé and Turenne, and Mazarin was, in diplomacy, a worthy successor of Richelieu. In 1643 Condé broke the Spanish infantry in the great battle of Rocroy in the Netherlands, and in 1644 he gained the great victory of Freiburg on the Upper Rhine. Other notable events were the battle of Nördlingen in 1645 and the invasion of Bavaria by Turenne in 1646. The result was that the empire consented to make peace, and the Thirty Years' War was ended by the peace of Westphalia (1648). France gained greatly. Her claim to Metz, Toul, and Verdun was recognized, and Alsace was added to her within ill-defined limits; in Italy, Pinerolo was recognized as French.

The empire had made peace, but the war with Spain still remained, and was complicated by the outbreak of civil war. The decisive event was the alliance which Mazarin managed to negotiate with Cromwell. The Spaniards were defeated at the battle of the Dunes (1658), and accepted the peace of the Pyrenees in 1659. Spain ceded territory on the northern frontier of France; but the most important point was a contract of marriage between Louis XIV. and the Infanta of Spain, coupled with a stipulation that the French king should renounce any inheritance of Spanish territory that might come through his wife. Meanwhile, from 1648 to 1653, France had been torn by the civil troubles of the Fronde. This strange movement was a last rally of the discontented and injured elements of French society against the crown. The chief part was taken at first by the Parliament of Paris, whose main object was to extort certain constitutional concessions from the crown. That phase was terminated by the peace of Rueil in 1648; but a new movement was almost immediately begun by the nobles, with the great Condé at their head. The rising was specially directed against Mazarin, who had twice to retire from France; but the movement lacked coherence and definite aim, and though the Frondeurs were helped by Spain, by 1658 Mazarin and the king were triumphant. The political movement had been accompanied by an interesting religious movement — Jansenism. This was no mere piece of political opportunism, but it bears the stamp of the ideas of the time, and may be described as an aristocratic protest against monarchy in the church.

Mazarin died in 1661, and Louis XIV. announced his intention of acting henceforward as his own first minister, and of conducting the government himself; and he persisted in his resolution to his death. At home Louis XIV. was the centre of the most splendid court in Europe. He was for the greater part of his reign genuinely and extremely popular, and the flattery heaped upon him, gross though it often was, was often really meant. His court was polished and refined, and the

France

standard of manners set there reacted beneficially on all Europe. He was a generous if not a very discriminating patron of letters, and his support of Molière deserves especial mention. He treated his wife, Maria Theresa, with neglect, and a succession of mistresses 'in title' occupied a prominent place at court. In 1683 Maria Theresa died, and in 1684 Louis was secretly married to Madame de Maintenon, who had been governess to his illegitimate children. The early years of his reign saw a splendid and successful effort on the part of his minister Colbert to reorganize the finances and industry of the country. Colbert was a man of great knowledge and energy, and while his influence lasted France was the best administered country in Europe. He established heavy protective tariffs for the newly planted industries. At the same time the army, the navy, and every department of the state was more carefully organized and directed. The religious history of the reign was also of great importance. The king was a sincere Catholic always, and towards the end of his reign his sincerity darkened into bigotry. The results were seen in the persecution of the Jansenists, who, however, still continued to exist, and to exert considerable influence on public opinion. But worse treatment fell on the Huguenots. They were no longer a danger to the monarchy; their members were peaceful, industrious, active both in trade and commerce; but their independent religious position offended the personal vanity and the religious bigotry of the king. In 1685 the Edict of Nantes (Henry IV.'s great measure of toleration) was withdrawn. The Huguenots were forced into submission or took refuge in exile. The loss thereby occasioned to France (moral, financial, and industrial) was one of the most serious blows sustained during the whole reign. The Catholic Church meantime was flourishing and vigorous not only by reason of its wealth and position, but also because of the character of its leaders, such as Bossuet, Fénelon, Bourdaloue, and Massillon. In 1682 the declaration of Gallican liberties was issued, defining the limits of the authority of the papacy.

Louis XIV. was very ambitious of military glory, and his reign was full of wars which may be briefly summarized. (1.) On the death of Philip IV., king of Spain, in 1665 Louis XIV. claimed certain portions of the Spanish Netherlands as descending to his wife by the right of devolution. The claim was resisted, but the country was overrun in a few weeks. To resist this aggression of the French king the Triple Alliance was formed between England, Holland, and Sweden, and in 1668 Louis XIV. accepted the treaty of Aix-la-Chapelle, whereby a strip of the Spanish Netherlands remained in the power of France. (2.) Louis was specially irritated against the Dutch for the part they had played in the Triple Alliance, and besides, he hated Holland for other reasons, both practical and sentimental. The French attack on Holland came in 1672, and at first the French arms carried all before them; but then William the Stadtholder called into existence an alliance of England, Spain, Brandenburg, and the empire, and the French advance was stopped. In 1678 the peace of Nimeguen was made, whereby France gained Franche Comté and other territories from Spain, but the Dutch territory remained intact. But immediately after the peace Louis increased his gains by the quasi-legal procedure of the Courts of Reunion. Large districts on the eastern frontier were annexed, of which Strassburg was the most important. (3.) The power of France was now regarded as dangerous and aggressive by the European states, and the war with the Grand Alliance was the result of this feeling. The English revolution of 1688 brought the Stadtholder of Holland to the throne of England, and William III. was the brain and soul of the alliance, which numbered in its ranks not only England and Holland, but also the empire, Brandenburg, Spain, and eventually Sweden, Denmark, and Savoy. The French were usually victorious both in battles and sieges, but the country was terribly exhausted by the expenses of the war. It was this chiefly which brought about the treaty of Ryswick in 1697, by which France made certain cessions of territory. (4.) In 1700 the death of the Spanish king brought about the war of the Spanish Succession. Charles II., by his will, had left the Spanish possessions to the grandson of Louis XIV. (Philip of Anjou). The union of the French and Spanish territories seemed to unsettle entirely the European balance, and a great coalition was formed to prevent the union (England, Holland, the empire, with certain smaller powers). France struggled against the armies of the coalition, led by Marlborough and Prince Eugene, up to the battle of Blenheim (1704). But that crushing blow entirely changed the situation; and henceforth France struggled against hopeless odds, constantly asking for a peace which the allies refused to grant. It is only possible to mention the chief battles. Ramillies in 1706, Oudenarde in 1708, Malplaquet in 1709 were all defeats for the French. Only in Spain did they gain victories (Almanza 1707, Villa Viciosa 1710). Peace came unexpectedly at Utrecht in 1713, and was brought about largely by a change of ministry in England.

Louis was succeeded by his great-grandson, Louis XV. His long reign saw the authority and popularity of the French monarchy entirely undermined, and laid the foundation of the destructive part of the revolution. For some years the Duke of Orleans was regent, and he at once reversed the whole policy of Louis XIV. Law, a Scottish exile, was allowed to attempt the reorganization of the finances, but his scheme ended in hopeless failure (1717–21). The Jansenists, persecuted in the last reign, were now liberated and patronized. Most important of all, France renounced her old hostility to England, and joined in a league to oppose the designs of Spain. The Duke of Orleans was served by Dubois, who practically managed all affairs of state; but both regent and minister died in 1723. Louis XV. came nominally of age in 1723, but for some time he was too young to exercise the reality of power, which fell into the hands first of Bourbon and then of Cardinal Fleury.

In 1733 Louis XV. entered upon the war of Polish Succession in support of the claims of his father-in-law, Stanislas Leczinski. France was defeated in the avowed object of the war, but by the peace of Vienna (1738) she converted her effective possession of Lorraine into a recognized and legal power. In 1740 the death of the Emperor Charles VI. brought on the war of the Austrian Succession, in which France, in alliance with Frederick of Prussia, fought against Maria Theresa of Austria and England. The French were defeated at Dettingen in 1743, and had previously been driven from Bavaria. But in 1745 they won the great battle of Fontenoy, and in 1747 the victory of Laffeldt gave them possession of Holland and the Netherlands. But the fighting of the war took place also in many other quarters of Europe, in India, and America.

In 1748 the peace of Aix-la-Chapelle established the *status quo* of the beginning of the war. But France having abandoned the alliance of Frederick of Prussia for that of Maria Theresa of Austria, the great war came in 1756. There have been few more important wars in European

history. The very existence of Prussia was at stake, and between England and France the stake fought for was the possession of India and the New World. The policy of France was weak and purposeless. The French arms were disgraced in Europe (Rossbach, 1757), and the English triumphed in India, America, and on the seas. These humiliations were confirmed by the peace of Paris (1763).

The domestic policy of the reign has many features of interest. The Parliament of Paris, so passive under Louis XIV., resisted the edicts of the king, until it was abolished in 1771. The union between the monarchy and the church was very close, and the growing weakness of the ecclesiastical power, culminating in the abolition of the Jesuit order in 1762, was a real blow to royal authority. Meanwhile a series of mistresses 'in title' squandered the resources and misguided the policy of France. The intellectual movement of the time was thoroughly destructive in its tendency. Voltaire, Rousseau, Diderot, Montesquieu, D'Alembert, however much they suffered from one another, agreed in opposing the existing régime both in church and state. The forces of the revolution were accumulating. There have been many more oppressive governments than that of France in the 18th century, but few more unstable. The people complained of poverty and unjust taxes; the philosophers attacked all existing institutions, and found no one to answer them. The nobility and clergy had both lost their former hold on the country; the monarchy, absolute in name, was in fact weak, unpopular, disorganized, and tottering to its fall.

The whole reign of Louis XVI. (1774–92) is merely a prelude to the revolution. He was humane, honest, and sincerely anxious for important reforms; but he was deficient in intellectual power, and wholly unequal to the task that was laid upon him. His wife, Marie Antoinette, with many admirable qualities, was a dangerous influence rather than an assistance. The reign opened brightly, for Louis XVI. appointed a ministry of zealous reformers, chief among whom was Turgot. The great interest of his career is that it was the only serious attempt made to introduce such reforms as might have prevented the revolution. Chief among his proposals was an effort to place an equitable burden of taxation upon the privileged classes. A court cabal, to which Marie Antoinette was a party, procured his downfall in May, 1776. He was succeeded in the office of controller of finance by Necker, a German banker, a capable financier, but not a reformer. His efforts to improve the financial system might have had some success if it had not been for the war with England on behalf of her revolted American colonies, which broke out in 1775. This war left the finances of France still further loaded with debt, and Necker's efforts to meet the financial crisis resulted only in his dismissal (1781). The next controller, Calonne, continued in office for some years by an elaborate system of borrowing at high interest. At last, unable to borrow more, he summoned an assembly of the 'Notables' of France (142 nominees of the crown) to consider the situation; but instead of helping him they supported the rapidly growing demand for the summoning of the States-general—a genuinely representative body. He was dismissed in 1787. His successor, Cardinal Loménie de Brienne, tried to impose taxes by royal edict, but the attempt broke down through the resistance of the Parliament. At last, in 1788, in despair of any other solution, the king summoned the States-general.

The opening of the States-general (May, 1789) marks the beginning of the French revolution. It may be noted that it was the product of three different impulses or wants. First, there was the urgent need of reform in the political government of France; next, France was full of vague but strong hopes of a vast social change that should destroy poverty and crime; third, the whole of France, and to some extent of Europe, was fermenting with new hopes, new ideals, which taken together amount to a profound though indefinite religious movement.

The first and mainly political phase lasted down to September, 1791. During these months changes of the vastest kind passed over France. The Assembly had three names before its course was run. First it was the States-general; then, on June 17, it took the title of the National Assembly; later it called itself the Constituent Assembly. The leading members were Lafayette, Bailly, Orleans, Mirabeau, Robespierre. It got through a prodigious amount of work, much of it of permanent effect. Feudalism was abolished. The church in France was put under the direct control of the state, and its property was confiscated. France was divided into departments, and the old provinces were abolished. A constitution was drawn up, on the basis of constitutional monarchy, with a single elective chamber resting on a broad but not universal suffrage. The work was carried out amidst much confusion, caused partly by the risings of the Paris people, partly by the resistance of the king, who, in June 1791, even fled from Paris in order not to be answerable for the work of the Assembly. But in the end he accepted that work, and consented to govern according to the terms of the constitution.

Many men thought that the revolution was at an end, but its most violent phase had not yet begun. Many causes precipitated France towards the Reign of Terror, but the most influential were the outbreak of a great war against Prussia and the empire, and the suspicion that the king sympathized with the foreign enemy. In October, 1792, the first (and last) Legislative Assembly met according to the constitution of 1790–1. The three chief parties were the Jacobins (extreme revolutionaries), the Girondists (more moderate), and the Feuillants (reactionaries). In April, 1792, war was declared against Austria, but the invasion of the Netherlands ended in failure. Prussia joined with Austria, and the invasion of France was meditated. The chief feeling in Paris was indignation against the suspected treason of the king. On August 10 the palace was stormed by an angry crowd, and the monarchy was declared suspended. In September a large number of prisoners, confined on suspicion of anti-revolutionary designs, were massacred. The chief agents in these sanguinary and important movements were not the Girondists, though they were in office at the time, but the leading Jacobins—Danton foremost of all, and after him Pétion, Marat, and many others. The general result was the establishment of the Jacobins in power and the calling of a new assembly, based on manhood suffrage, to be called the Convention.

The Convention sat from September, 1792, to 1795. During its sessions France passed through an amazing transformation. The monarchy was declared abolished, and the republic was proclaimed. Then, by the energy and success of their foreign policy, as well as by their violence at home, the Jacobins gained a complete mastery of France. Louis XVI. was guillotined in January, 1793, and Marie Antoinette in October of the same year. The Girondist party was crushed and many of its members executed. The Committee of Public Safety (with Danton as the chief influence at first

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and afterwards Robespierre) was the chief agency of government, and Carnot undertook the general direction of the campaign. Dangers of every kind, external and internal, seemed to threaten the revolutionary government with destruction. There was a revolt of the Catholic population of La Vendée, civil war in the centre and south of France, fierce faction fights in Paris, while on the frontiers, Prussia, the empire, England, and Holland were leagued together for the punishment of France. Yet the Jacobins triumphed over all enemies. At the same time a series of remarkable domestic measures were passed. Christianity was declared abolished, and in its place was established first the worship of Reason, and then (by Robespierre) that of the Supreme Being. A new calendar and a new era (commencing in 1792) and a decimal system of weights and measures were adopted. The government was meanwhile supported by measures of the most violent kind, which, taken together, are known to history as the Reign of Terror. This system was worked by Danton, Marat, and Robespierre; but Danton was executed, Marat was assassinated, and for some time Robespierre exercised something like a dictatorship. When, in July 1794, Robespierre himself fell, the Reign of Terror came to an end, and a strong reaction set in towards constitutional government. A new constitution was drawn up, whereby the executive was to be vested in five directors, and the single legislative chamber was to be replaced by a Council of Ancients and a Council of Five Hundred. The rising of Vendémiaire, directed against the Constitution (the constitution of the year III.), was crushed by Napoleon. With this year his prominent career begins, and the history of the battles and campaigns which carried the French arms into every corner of Europe must be looked for under his name. Here the domestic history of France will alone be followed.

We will first note the successive changes in the form of government. (1.) The Directory, established in 1795, lasted until 1799, in spite of much discontent and opposition. In 1799 it was overthrown by the revolution of Brumaire (Nov. 9), which was chiefly the work of Sieyès and Napoleon. (2.) Shortly afterwards (Dec. 24) the constitution of the year VIII. was drawn up, by which the executive was vested in three consuls, with Napoleon as first consul, and all the machinery of government was rearranged on more conservative and autocratic principles. (3.) In 1802, after the peace of Amiens, Napoleon was appointed 'First Consul for life,' and the title was ratified by the French people. (4.) In 1804 all veils were cast aside, and Napoleon became emperor of the French, and in December he was crowned at Paris by Pope Pius VII. This title Napoleon maintained until his abdication in 1814 and his exile to Elba. This title he resumed when he landed in France in 1815, and he claimed it still in his exile in St. Helena.

While all Europe was convulsed with wars of unexampled magnitude, peaceful progress was not entirely at a standstill in France. The restless energy and genius of Napoleon overhauled the whole machinery of administration. Commerce, agriculture, manufacture, the revenue, museums, libraries, education, public works, all received a powerful impulse at his hand. The two most definite results of his activity were: (1.) The concordat with the pope, whereby the Catholic church became once more the official church of France, but the appointment of all ecclesiastical officials was vested in the emperor. (2.) Cambacérès, the second consul, undertook a systematic digest of the laws of France, which resulted in the Code Civil or Code Napoléon, which was promulgated in March 1803. France still bears, deeply imprinted on every part of her life, the results of these two acts.

The year 1815 seemed a year of cataclysm. Louis XVIII., brother of Louis XVI. (for the boy king, Louis XVII., had died in prison), succeeded to the throne promising to govern according to the provision of a Charter of Liberties, and, despite occasional troubles with the church and the people, the new throne seemed firm during his lifetime. Louis XVIII. died in 1824, and his brother Charles X. succeeded him. He was a more ardent champion of religion and political absolutism than his brother, and six years sufficed to bring the monarchy to irretrievable disaster. The conflict came in 1830, through the issue by the king of five *ordonnances*, of which the chief submitted the press to a rigid censorship and made important changes in the character of the constitution. Paris rose; the Tuileries palace was sacked. The king, unable to resist, fled to England. But France was not yet ready to resume the experiment of the republic. The Chamber invited Louis Philippe, a relation of the exiled king, and the son of Philippe Egalité, Duke of Orleans, to become their constitutional king. He ruled until 1848.

The king was served by great ministers, of whom Casimir Périer, Thiers, Guizot, and Soult were the chief, and in many respects France made undeniable progress during his reign. Despite the king's pacific desires, France was engaged in three wars of some importance. A war with Algiers from 1830 to 1847 resulted in the annexation of the country. Other wars were fought with Mexico (1838–9) and with Morocco (1844). But the matter of most importance during this reign was the agitation and violence of public opinion. The ideas of socialism were definitely pronounced by Louis Blanc. In 1840 the body of Napoleon was brought from St. Helena and buried amid great excitement in Paris. The ideas recalled and suggested by the event were certain to be dangerous to the essentially commonplace and bourgeois régime of Louis Philippe. The Napoleonic tradition was also renewed by the historical work of Thiers. In 1836, and again in 1840, Louis Napoleon attempted to overthrow the government, but failed somewhat ignominiously. In 1847 Guizot was prime minister, but he steadily and firmly resisted all agitation for reform. The movement, however, culminated in 1848. There was a revolutionary outbreak in Paris on February 21. Guizot resigned, but the movement did not subside. Four days later Louis Philippe, thinking resistance hopeless, somewhat pusillanimously abdicated the throne.

A provisional government, consisting of Lamartine, Louis Blanc, and Ledru Rollin, and others was established. Universal suffrage was declared, and a constitutional assembly summoned. The republic was declared, but the new form of government was only established after several days of desperate street fighting. The new government consisted of a president, with extensive executive powers, and a single chamber, from which all state officials were excluded. Louis Napoleon hastened over from England, and was elected president by a great majority. The new constitution satisfied few people, and proved very unstable. The president used every effort to gain popularity at the expense of his ministers and the Chamber. In December, 1851, he dissolved the Assembly by proclamation, made himself dictator, and appealed to the people to ratify what he had done: 7,500,000 voted in his favor and only 650,000 against him. He found himself strong enough to take a further step. In December, 1852, he was proclaimed emperor, with the title of Napoleon III. Under this title he reigned for eighteen troubled years. He had announced that 'the empire meant peace,' but the Napoleonic

tradition could only be maintained by war. The reign saw therefore a series of wars. (1). Napoleon III. invaded Italy (1859), and fought against the Austrian power, nominally for the liberation of Italy. But after the great victories of Magenta and Solferino he accepted the peace of Villa Franca (1859) whereby Lombardy became Italian, while France took Savoy and Nice. (2.) In 1863 he entered upon an expedition against Mexico, with a view to re-establishing a great French and Catholic empire there to balance the United States. But the resistance was much greater than was anticipated; European affairs were very threatening, and in 1865 the expedition was abandoned. (3.) Yet these were but a tame prelude to 1870—the real *année terrible* of French and European history. The unscrupulous ambition of two men—Napoleon III. and Bismarck—came into collision. France entered upon the war with the most confident anticipations of success. Then there came the terrible disillusioning. The French were defeated at Weissenburg (Aug. 4, 1870), at Wörth (Aug. 6), at Spicheren (Aug. 6), at Gravelotte (Aug. 18), and, as a result of the last battle, Marshal Bazaine and a large army were cooped up in Metz. An army under Napoleon himself went to their relief, but the French were disastrously defeated at Sedan (Sept. 2), and Napoleon surrendered with 83,000 men.

This terrible news overturned the empire. The republic was proclaimed from the Hôtel de Ville. The Germans claimed concessions of territory; these were refused them, and their army in consequence marched upon Paris The city, under the direction of the government of National Defence, prepared itself for a heroic resistance. Jules Favre was minister of foreign affairs, Gambetta of the interior, and General Trochu was given the military supervision of Paris. Gambetta escaped from the capital in order to raise armies of relief in the provinces; and though he failed, he threw the greatest energy into the effort. Paris itself was agitated by political passions, and united only in hatred of the enemy. At last famine did its work, and in January, 1871, France had to surrender very nearly on the terms that Germany proposed. All Alsace (except Belfort) and part of Lorraine were to be surrendered, and a war indemnity of $1,000,000,000 was to be paid. German troops were to remain in France until all was paid off. These terms were embodied in the treaty of Frankfort (May 10).

But before that time the commune had broken out in Paris. Bitter dislike of the surrender, a desire even to prolong the war, political theories, both of the socialist and the anarchist types, and a desire for disorder and plunder, all played their part in producing the amazing outbreak. For some time the insurgents were in possession of the city. The commune began on March 18, 1871, and was not ended until May 21, after vast loss of life and destruction of property.

On Feb. 13, 1871, the National Assembly, elected after the fall of Paris, met at Bordeaux, and assumed the reins of power hitherto held by the government of National Defence. Since the meeting of the States-general in 1789 no representative body had contained so many distinguished men. The majority of its members were royalists, and had the monarchists not been divided among themselves as royalist supporters of the Comte de Chambord, grandson of Charles X., and as Orleanists supporting the claims of the Comte de Paris, grandson of Louis Philippe, the monarchy might have been restored. Disagreeing on the essential point of the choice of a sovereign, the majority decided to allow the republic, declared after Sedan, to grapple with the disastrous state of affairs. M. Thiers was elected chief of the executive power at Bordeaux on February 17, and received the title of president of the republic; and from this point the history of the third republic begins. In spite of the burdens of the war indemnity the vitality of the country seemed unimpaired. Within three years the indemnity was cleared off, France was freed from the presence of the enemy in her territories, and her shattered forces were reorganized.

As soon, however, as the German occupation ended, political unanimity disappeared. The radical strength in the Chamber increased, and to meet its demands the ministry was modified. The monarchists in turn attacked the ministry, and a vote of censure forced M. Thiers to tender his resignation in 1873, and Marshal MacMahon, Duc de Magenta, was elected president. In November, 1873, a bill was passed which instituted the septennate, thereby confirming MacMahon in the presidency for seven years. His first cabinet was a coalition one, composed of the three monarchical parties. For eighteen months the different aims of these factions prevented action on the constitutional laws; but in 1875 the Assembly adopted laws providing for the constitution of the national legislature, the legislative power to be vested in a Senate and a Chamber of Deputies. This body of laws, generally known as the 'Constitution of 1875,' has lasted without material alteration to the present time. In 1877 President MacMahon was suspected of reactionary designs; but the republican form of government was, nevertheless, greatly consolidated during his tenure of office, and enjoyed the increasing confidence of the nation. On MacMahon's resignation, in 1879, M. Jules Grévy was elected.

After 1879, under various changes of ministry, the policy of the government remained steadily republican. At the instance of M. Jules Ferry, minister of education, a decree was issued in 1880, by which members of any 'unauthorized' religious orders exercising the profession of teaching in any school in France, and all religious orders which would not submit to certain conditions necessary to gain the state sanction, were dissolved. This enactment was aimed chiefly at the Jesuits. In 1884 the constitution and the senatorial electoral system were revised and put upon their present basis. The following year members of the royal houses which had formerly ruled France were declared ineligible for military or civil office.

In 1881 France entered upon an active colonial policy by undertaking a military expedition to Tunis, and establishing a protectorate over that country. In 1883 she enforced a claim of certain rights over the northwestern part of Madagascar by taking possession of certain ports. Rapidly extending her influence in spite of considerable reverses, she succeeded in establishing a protectorate over the island in 1885, and in 1896 reduced Madagascar to the rank of a French possession. The advance of France in Indo-China led to war with China in 1883–5, which resulted in the establishment of a French protectorate over Annam and Tong-king. In 1885 M. Grévy, although his unpopularity was increasing, was re-elected. He resigned in 1887 and was succeeded by M. Sadi-Carnot, during whose administration the Panama Canal scandal occurred, involving many prominent men and weakening the government (see PANAMA CANAL).

The Carnot administration witnessed the most formidable attempt yet made to overthrow the republic. This was the agitation commenced by all the discontented elements in the country, united only by their hostility to the government, under

the leadership of General Boulanger (1888). For a time it appeared as if the republic was doomed to fall before a *coup d'état*. But Boulanger lost his popularity, and fled the country. His flight was the death of Boulangism.

In 1894 President Carnot was assassinated at Lyons by an Italian anarchist, and was succeeded by M. Casimir-Périer, who resigned in 1895, and was followed by M. Félix Faure. The most notable events of these years were the Franco-Russian *entente* and the Dreyfus case (q. v.). In 1898 an Anglo-French agreement was signed, settling the territorial boundary at the bend of the Niger, and the Marchand mission was recalled from Fashoda. Upon the death of President Faure, in 1899, Emile Loubet was elected president. An important agreement was signed on April 8, 1904, consisting of a convention with regard to Newfoundland and West Africa, a declaration dealing with Egypt and Morocco, and another relating to Siam, Madagascar, and the New Hebrides. The visit of the British fleet to Brest in 1905, and the return visit of the French fleet to British waters, together with the signing of a new Anglo-French treaty, emphasized the *entente cordiale* between the two countries, which was further strengthened by the Franco-British Exposition in London in 1908. President Loubet was succeeded in 1906 by Clément Armand Fallières.

The strained relations between the government and the Catholic Church had culminated in 1905 with the passage of an act abrogating the Concordat (q. v.). The state took over the control of church properties and schools, and a supplementary act of 1907 placed the Roman Church on the same footing as Protestant and Jewish congregations. The papal denunciation of Modernism in 1910, the hostility of the Vatican to the growing power of Socialism, the fixing of confirmation at the seventh year, and the threat to refuse burial to all unconfessed or those not receiving the Communion at Easter, resulted in a popular appeal for a stricter enforcement of the law of 1905, and the situation threatened to become acute. The problem was, however, pushed into the background by the outbreak of the European War in 1914.

In June, 1908, there occurred a serious uprising of the wine growers in the 'Midi' district owing to dissatisfaction over the injury done to that industry by foreign competition and by the wholesale adulteration of wines. Troops were despatched to the affected districts, the uprising was suppressed, and remedial legislation was adopted—notably a 'delimitation' decree designed to restrict the application of the word champagne to wines grown in certain areas, including the department of the Marne and adjacent communes in Aisne and Haute-Marne. The Aube wine growers protested against their exclusion, and serious demonstrations both against the measure and in its behalf occurred in 1911. The controversy was finally settled by abandonment of the delimitation policy, and resort to the laws of 1824 against adulteration and imitation.

In August, 1908, an attempted general strike of all laborers failed. In March, 1909, a strike of post-office and telegraph employees caused great inconvenience until settled by compromise. This was followed in October, 1910, by a railway strike which threatened to become general, but which was checked by the prompt action of Premier Briand, who, taking advantage of the act providing for universal military service, called the strikers to the colors and ordered them to operate the roads.

During the period from 1905 to 1912 relations with Germany were severely strained over the Moroccan situation. German interference in Morocco in 1905 led to the calling of an International Conference at Algeciras, Spain, on March 27, 1906, when an agreement was reached whereby France was granted certain police powers and other concessions (see MOROCCO) in Morocco. In 1907 the Casablanca incident, caused by the sheltering of French deserters by the German consul at that Moroccan town, threatened the relations between the two countries until settled by arbitration at The Hague. A third crisis occurred in 1911. In May of that year a French force was despatched to Fez to quell a revolt of certain of the southern Berber tribes. The force was not immediately withdrawn, and Germany, claiming a breach of the Algeciras convention, despatched the German warship *Panther* to Agadir (q. v.), while German troops were landed in the town. At this juncture Great Britain intervened, and diplomatic interchanges followed, issuing in the treaty of Nov. 4, 1911, by which Germany again acknowledged the French protectorate, receiving in return equality in trade and part of the French Congo, for which France received part of the German Kamerun. Treaties with Spain and Morocco were signed in 1912. By the former Spain received part of the Northern zone of Morocco for part of the Southern zone, with the proviso that no fortifications should be erected, but with the privilege of collecting duties, part of which should go toward the debt of Morocco. The treaty with Morocco prohibited the Sultan from contracting any debts or granting any concessions without the consent of France.

The year 1912 saw France in altercation with Italy, then at war with Turkey, over the seizure of the *Carthage* and the *Manouba*, two French steamers charged with transporting aeroplanes and Turkish officials to Tripoli. France was able, however, to prove that the aeroplanes were for exhibition purposes only and that the Turks were members of the Red Crescent Society—the Turkish Red Cross. This closed the incident. The concentration of the French Atlantic fleet in the Mediterranean (1912) and of the British Mediterranean fleet at Gibraltar was a matter of much concern to Austria.

In the period from 1910 to the outbreak of the Great War in 1914 a number of disasters marked the history of France. In January and February, 1910, the most serious floods ever recorded occurred in the Seine district. At Paris the river overflowed a considerable portion of its banks and caused enormous destruction of property (see PARIS). The failure of the wine crop in 1910 entailed a loss of $1,000,000, and the destruction of the battleship *Liberté* (1911) by internal explosion resulted in much loss of life.

Of public enterprises two stand out boldly, the electrification of St. Lazarre Station and the Paris belt line (1911), and the beginning of the great tunnels designed to connect France with Italy and Central Europe.

Of notable legislation just prior to the war, much of it due to the Socialist party, the following may be mentioned: an act instituting old age pensions for all over 65 (effective 1911), the premiums (men, 9 francs; women, 6 francs; boys (14), 4 francs) being paid by employers, and employees, and a *viagère* being added by the government for those over 65; a bill for the eight-hour day for all miners and quarrymen, passed by the Chamber in 1912 but delayed in the Senate until 1919, owing to the war; an act permitting labor to act in a corporate capacity (1913); and acts safeguarding the health of children, regulating tenements, and amending the pension law and laws against food adulteration. Along other than social lines legislation of

France

importance included the adoption of Greenwich time for France and Algiers (1912), a compromise in electoral reforms between proportional representation and the majority system; a naval program calling for 90 warships by 1920; the change from a two to a three-year military service term (1913); and the establishment of land credits under government control (law of 1852), the Credit Foncier being given a practical monopoly. In 1913 Raymond Poincaré was elected president.

With the fateful year of 1914 France was plunged into war with the Central Powers (see EUROPE, GREAT WAR OF) by virtue of her defensive alliance with Russia, whereby each was pledged to go to the other's defence in case of attack. Germany's declaration of war against Russia, Aug. 1, 1914, and mobilization on the Russian frontier called forth France's declaration against Germany Aug. 3. This was followed by England's declaration, Aug. 5, bringing France, England, and Russia into alliance. The Germans swept the French and Allied troops toward Paris, reaching the Marne in September, the limit of the German invasion, and causing the removal of the French government from Paris to Bordeaux (Sept. 3, 1914), where it remained until Dec. 11, 1914. After the declaration of war a general moratorium was announced (1914) and withdrawals from banks were regulated. The government also took control (1915) of the sale of alcoholic liquors and prohibited the sale of absinthe.

Frequent cabinet changes marked the war period. Ministry followed ministry, each striving to organize the country and the government for the better prosecution of the war, but the successful German drives, the unfortunate attempts at Gallipoli, and the apparent vacillating course with Greece, weakened the people's confidence. Premier after premier resigned, eight in all holding office from June 1, 1914, to Nov. 15, 1917, when Dr. Georges Clemenceau (q.v.) was elected. During these successive ministries transportation, sanitation, and munitions were placed in charge of under-secretaries (1914), a war committee of five members was appointed (1916), and General Foch was appointed to the command of the Allied armies. In addition to these measures, taxes were increased on incomes and levied on legal documents, including marriage licenses.

The year 1918 saw the clearing of the Germans from Northern France, the complete collapse of the Central Powers, and the signing of the Armistice, Nov. 11, 1918. The effects of the war in France were appalling. The population decreased over three-quarters of a million, exclusive of deaths in Northern France and others directly due to the war; 7,000,000 acres of land were found to have been rendered uncultivable, 250,000 buildings were destroyed during the conflict—among them the Cathedrals of Rheims, Arras, Soissons, Albert, and Peronne; while the important towns of Ham, Noyon, Nesle, Roye, Soissons, Fismes, Ypres, and Rheims were desolated. The indebtedness, including loans from England and America, reached the enormous total of $155,600,000,000. To meet this great burden a lottery bill was introduced July 4, 1919. For measures to alleviate the conditions caused by the War, see RECONSTRUCTION.

The rapid growth of the Socialist Party has been one of the outstanding features of French history of the past few decades, the Socialist vote growing from 30,000 in 1885 to 1,106,000 in 1910, and 1,400,000 in 1915. This growth was paralleled by a changing attitude toward the government as the balance of power swung from the conservative to the radical element. Prior to the war (1914) and during the first years of it the Socialist Party stood solidly behind the government, but gradually the radical element gained ascendancy, until in 1918 it held the balance of power. It condemned the refusal of passports to the Stockholm labor convention where German delegates were in attendance, and did not hesitate to blame the government for all the misfortunes incident to the war, or to oppose with all its might such legislation as seemed to it to be anti-socialistic, though designed for the more efficient prosecution of hostilities. It attacked the renewal of the charter to the Bank of France; the concentration of authority for the more vigorous conduct of the war; the change from the two-year term of military service to the three-year, designed to meet the large increase in the German army, and harassed the government with demands for a revision of the aims of the war. It charged the government also with undue leniency in carrying out the laws of 1905 enacted against the various churches and religious associations, having in mind the Roman Church, which had antagonized it by denouncing modernism as anti-catholic and socialistic, and socialism as atheistical. Even before the war the Socialists had been much disturbed by Premier Briand's method in suppressing the great railroad strike of 1910, while the calling of troops to settle the champagne controversy (1911) had also offended them. Other incidents of less importance fanned the flame of opposition until on Nov. 11, 1918, the day of the singing of the Armistice, the Permanent Administration Committee passed resolutions praising the soviet government of Russia and condemning military intervention. When, on May 1, 1919, the day appointed by the party for a protest strike, troops were called to preserve order, the socialist members resigned from the cabinet.

Beginning with 1910 and continuing through the war an epidemic of scandals scourged France, the most famous of which was the notorious Caillaux case, which antedated the outbreak of the war, culminating in March, 1914, in the murder of Gaston Calmette, editor of the *Figaro*, by Mme. Caillaux, who had been rendered desperate by Calmette's journalistic attacks upon her husband. The attacks were based upon Caillaux' official misconduct as Premier and upon his secret intercourse with Germany during the Moroccan crisis. Mme. Caillaux was brought to trial but was acquitted and her husband resigned from the Cabinet in which he was Minister of Finance. Subsequently he was arrested (Jan. 15, 1918) for traitorous communication with the enemy during the Great War (1914–18), and was brought to trial on a charge of high treason.

A new political party, *La Democratie Nouvelle*, was organized in May, 1919, to perpetuate the Clemenceau traditions and exterminate Bolshevism, to eliminate political parasites and establish a responsible and competent power to govern in the spirit of free institutions.

Just before the signing of the Peace Treaty, the United States, England, and France entered into a treaty binding the first two to assist France in case of an unprovoked attack by Germany. The public celebration of the signing of the Peace Treaty was held on the 130th anniversary of the fall of the Bastille, July 14, 1919.

After the signing of the Versailles Treaty difficulties of all sorts began. During the hostilities and the Peace Conference domestic questions had naturally remained in abeyance, but now the old party controversies again broke out. A general election was held on November 16, 1919: it proved to be a victory for the moderate groups, and the election of M. Deschanel as President of the Republic (Jan. 17, 1920)

marked the liberal tendencies of the new Chamber.

But the chief difficulties were those relating to the financial entanglements of the country. After the enormous expenses incurred during the war the treasury was empty and the national debt amounted to no less a sum than 30 billion dollars. The ordinary budget presented a deficit of two billion francs and it was foreseen that the extraordinary expenditure for the reconstruction would exceed seven billions more. It became evident that if Germany did not pay her war debt and did not help in the reconstruction France could never recover. Consequently negotiations with the Allies began but did not bring the longed-for solution. With M. Briand who succeeded M. Leygues as Prime Minister (Jan. 1921) and M. Millerand who took the place of M. Deschanel who, after a serious accident, had been obliged to resign (Sept. 1920) some progress was made. A conference was held in Paris after which the terms of an agreement settling the question of reparations and disarmament were sent to Germany. In another conference in London a German delegation presented impossible counter-proposals. Mr. Lloyd George firmly insisted upon Germany honestly discharging her obligations, and as that country continued stubborn, the British with France and Belgium occupied the cities of Ruhrort, Duisburg and Düsseldorf. As a result of this friendly coöperation the franc improved from 12 to 10 francs to the dollar.

At the same time Franco-American relations were at their best, and, in August, 1921, diplomatic relations with the Vatican were re-established. But this promising outlook was not to last. The French were greatly disappointed when Germany declared her inability to pay what was expected of her for 1922. A conference which took place at Cannes (Jan. 1922) yielded no other result than the decision to hold another conference at Genoa.

This disappointment rendered M. Briand's position impossible. Accordingly, finding that he had no longer the support of Parliament he resigned and was succeeded by M. Poincaré (Jan. 15, 1922). The advent of the latter was marked by a distinct change in method. M. Poincaré, aware that conferences led to an unnecessary display of oratory and produced no results, decided to revert to the old procedure of direct negotiations with the different governments. He could not, however, refuse to participate in the Genoa conference which had been scheduled for March, but he took the precaution to affirm France's position on two vital points: (1) that the treaties drawn up by the Peace Conference should not be modified; (2) that the *rôle* of the League of Nations should not by any means be assumed by the new conference. To these conditions Mr. Lloyd George gave his consent.

The Genoa conference proved as futile as the preceding ones and so did the Hague conference that followed in June. Neither the question of the relations with Soviet Russia nor the question of the enforcement of the Versailles treaty received a solution. France managed solely to safeguard her rights, but this did not improve her financial situation.

Toward the middle of the year Parliament passed the 18 months' Service Bill which reduced the French army considerably. With the end of the year 1922 it became clear that Germany was resolved upon evading her obligations in the matter of reparations. The public, as well as the Government, became alarmed, for finding that the sympathies of the world now were with Germany and Russia rather than with France, it was impossible to see how reconstruction could be carried on, and the debt to England and to the United States be paid if no indemnity was received from Germany. After another conference on reparations, held in Paris, had proved fruitless, M. Poincaré, responding to the popular feeling, announced his intention of seizing some gage which he would keep until Germany fulfilled her obligations. Consequently French and Belgian troops occupied the Ruhr district (Jan. 10, 1923), and measures were taken to exploit that industrial section of Germany in the name of the Allies. This policy met with strong opposition not only on the part of Germany but also of England. M. Poincaré, nevertheless, persisted in his intent not to withdraw the troops before Germany began to pay her debt and to this policy he adhered firmly. As a result, in May 1923, Germany which had organized 'passive resistance' in the Ruhr began to approach the Allies with certain offers and after some months' negotiations the German government promised that 'passive resistance' would cease.

This was a great success for M. Poincaré; but Germany's refusal to contribute to the reparations had rendered the financial situation still more desperate. The work of reconstruction had necessarily been pursued in the meantime, and enormous sums, which brought the total deficit up to 17 billions had been spent, while all the time the fall of the franc, accelerated by the manœuvres of international speculators, had continued, until the dollar was worth about thirty francs.

Meanwhile the relations with England had been of the coldest, but at the beginning of 1924 the Baldwin Government was defeated, and paradoxically enough the Labour Government that succeeded worked on more friendly terms with the moderate French Government than the English Conservatives had done, a fact which, no doubt, did much to facilitate the work of the Dawes Committee, whose purpose it was to fix the reparation payments and also to help to stabilize the German currency. (See DAWES REPORT ON REPARATIONS.)

In the early months of 1924 the attention of the French began to be somewhat diverted from the financial problems towards political controversies. The minority, including the Socialists and the Radical-Socialists formed a combination or *Bloc des Gauches* which was to oppose the combination of the moderate parties or *Bloc National*. Their hopes were more than realized. A change of Government appeared to the disheartened Frenchmen as a panacea and the parties of the Left won an overwhelming victory.

The first act of the new Chamber was to oust M. Millerand who was the founder of the *Bloc National* from the presidency. The *Bloc des Gauches* refused to form a cabinet so long as their political adversary was at the Elysée. M. Millerand resigned, and, on June 13, the National assembly met at Versailles to elect a new president. M. Doumergue, a moderate Radical-Socialist, was chosen, and M. Herriot, the leader of the Radical-Socialist party formed the Ministry.

The new Chamber had been elected upon an anti-clerical platform. Accordingly, M. Herriot's first step was to propose the suppression of the embassy at the Vatican. This decision immediately revived the religious passions which before the war had existed in France. Protest came from the Catholics throughout France, none more violent than those which were uttered in Alsace-Lorraine. For that recovered province is still under the régime of the Concordat and is deeply attached to its traditions. The agitation became so great that it was found necessary to drop the religious controversy, and so complete was the reversal of opinion that in the following year the President of the Republic himself gave the Papal Nuncio Mgr. Ceretti, the biretta when the Legate was made a Cardinal, (Dec. 20, 1925).

Paul's Photos, Chicago

PARIS VIEWED FROM THE CATHEDRAL OF NOTRE DAME

The majestic Eiffel Tower may be seen in the distance, to the right.

THE ARC DE TRIOMPHE DU CARROUSEL, PARIS, BUILT TO HONOR NAPOLEON'S VICTORY

France

Another political move of the Herriot Cabinet was to introduce an Amnesty Bill which was to be granted to all who had been guilty of political offenses.

In foreign matters M. Herriot on July 16, at a Conference held in London, signed an accord approving of the Dawes Plan. Germany in her turn accepted the arrangement and it was decided that the Ruhr occupation would be rendered 'invisible,' and that the evacuation would be completed at the latest in September 1925.

Financial affairs continued to be unsatisfactory and rumors of a capital levy began to alarm the French and their emotion augmented when they learned that secret inflation had been resorted to. M. Herriot resigned, the fall of the Cabinet set an end to the policy of the *Bloc des Gauches*, and when M. Painlevé, the leader of the Republican-Socialist party, was called upon to form a new ministry (April, 1925) he announced that a policy of appeasement was indispensable.

At the beginning of May certain Moroccan tribes at the instigation of an adventurer named Abd-el-Krim revolted, but M. Painlevé resisting the pressure of the Socialists who advocated peace at any cost, stood up for the rights of France and collaborated with the Spaniards who had also been attacked in their own zone. The insurrection did not end until the following year when Abd-el-Krim was forced to surrender unconditionally (May 26, 1926).

The Painlevé cabinet was forced to face a similar crisis in Syria, which the French hold under a mandate of the League of Nations. Early in August, 1925, the Druses attacked the Syrian troops and in the fall the revolt assumed a menacing character. General Sarrail, who had been appointed governor, failing to repress the insurrection, was recalled, and was replaced by M. Henri de Jouvenel, a senator, as High Commissioner and order was finally restored.

In the meantime, M. Caillaux turned to the question of the foreign debts. In August, 1925, he signed with Mr. Churchill a provisional agreement which was to become final if the United States consented to a similar arrangement. Whereupon M. Caillaux sailed for America but finding that the United States Government was not prepared to accept the sums offered he was obliged to leave without anything being settled.

This failure made M. Caillaux's position difficult, and matters became worse when the Radical Congress at Nice decided to insist upon a capital levy. M. Caillaux, though he belonged to the Radical party, was, as a financier, opposed to such a measure, and M. Painlevé felt bound to dismiss his Finance Minister. In order to effect this, he resigned and two days later formed a new cabinet in which he himself assumed the *rôle* of Finance Minister, and set about preparing a plan to save the nation from disaster. This project was defeated and the Ministry resigned (Nov. 22, 1925).

M. Briand undertook the difficult task of forming a new cabinet. The deputies could not agree upon any of the means proposed to balance the budget. On the 6th of March, 1926, the Cabinet was defeated on a question of taxes and M. Briand was compelled to resign. Just a few days before he had, however, been able to make the Chamber ratify the Locarno agreement. (See LOCARNO TREATIES).

On March 10, M. Briand formed a new cabinet, this time with M. Péret as Finance Minister, upon whom fell the responsibility of accepting the agreement with the United States in regard to the French debt, signed by M. Bérenger on April 29, 1926. But this agreement was found unacceptable by the French Chamber, since it did not contain any safeguarding clause in case the German payments should cease. Indeed, the Dawes plan, in that respect, was far more lenient to Germany for it provided for a suspension of payments if those payments endangered the value of the mark. For this reason the French Government in spite of all its efforts could not obtain the ratification of the Bérenger agreement by Parliament.

As those discussions were going on the fall of the franc had continued. In June it dropped to nearly 36 to the dollar, when M. Péret, finding himself unable to tackle the task retired, his retirement involving the resignation of the whole cabinet. This time, M. Briand tried a cabinet of the Left with M. Caillaux again as Finance Minister. M. Caillaux hastened to sign an agreement with Mr. Churchill fixing the payments which France promised to make in the following years. Having settled the question of the English debt he asked Parliament for dictatorial powers enabling him to solve all the financial problems without being impeded by lengthy debates. This was taken by the deputies as an attempt at dictatorship and M. Caillaux's demand was violently resisted. The Government once more was defeated and there followed a moment of tragic suspense. The franc fell lower and lower. M. Herriot, called upon to form the ministry, chose M. de Monzie as Finance Minister. But the sentiment of distrust in the nation at large was such that on the day when the cabinet was presented to the Chamber of Deputies, citizens marched upon the Palais-Bourbon and the Elysée demanding that the deputies immediately cease their quarrels.

M. Poincaré appeared as the only man who was capable of saving the country and at the request of M. Doumergue he formed a cabinet on July 23, 1926. He immediately introduced a finance bill and the Premier, who was his own Finance Minister, began that series of administrative reforms that was to be the prelude of the restoration of French finances. He then instituted and made constitutional with the approval of a National Assembly, a sinking fund that was entrusted with the task of absorbing the floating debt. The franc began at once to improve until towards the end of the year it settled on the level of 25 to the dollar, and in June, 1928, it was stabilized at 25.52, the stabilization bill being passed by a large majority.

While M. Poincaré was improving French finances, M. Briand, as Minister of Foreign Affairs, was attempting to bring about a rapprochement with Germany. In August, 1926, a tentative Franco-German commercial arrangement was concluded. In September, France sanctioned the admission of Germany to the League of Nations, and in the same month M. Briand and Herr Stresemann held an interview at Thoiry in which improvements in the relations between the two countries were studied. A little later a European steel trust was formed including the industries of France, Germany and Luxemburg.

The same policy was pursued through the year 1927. With France's approbation the Reich was admitted to the Committee of Mandates in the League of Nations, and in August a Franco-German commercial treaty was signed. A few weeks before Parliament had passed a twelve months' Service Bill resulting in a further reduction of the French army. The year 1927 would have been peaceful enough had it not been for the discovery that the Reich had not carried out all the stipulations of the Peace Treaty in the matter of disarmament, a fact which caused some stir at Geneva. This disagreement was settled by a compromise and the French Government could then devote all its

France

efforts to a methodical improvement of the financial situation. By a series of cumulative measures M. Poincaré succeeded in diminishing the floating debt and the advances of the Banque de France to the State, so that France was soon able to begin the payments of the English debt. The recovery was so miraculous that all party strife perforce ceased and in May, 1928, when a general election took place, a strong majority of deputies favorable to M. Poincaré's policy was returned.

The newly-elected French Parliament met on June 1, 1928, and on the 7th M. Poincaré announced his program. Legal stabilization of the franc and a return to the gold standard were adopted by overwhelming majorities on June 24. The Government in July began prosecution of judges, lawyers and court clerks charged with unlawfully facilitating American divorce actions in Paris. Suspension and reprimand were imposed upon seven lawyers, one registrar and a bailiff. In August the Briand-Kellogg Treaty to outlaw war was signed at Paris. See PEACE PACT OF PARIS: Vol. IX, page 268F.

French Communists seized the occasion to make demonstration against the signing of that treaty; collisions with the police led to the mobilization of steel-helmeted reserves around the Foreign Office where the treaty was being concluded. French courts decreed (Oct. 17, 1928) that American firms operating branches in France must pay double profit tax, one for the parent company and another for the subsidiary plant.

Provisions were inserted in the budget bill for the return of confiscated property to the Church, and that Catholic missionary societies should be permitted to establish training centers in France. There was also an appropriation of 4,000,000 francs for secular priests in Syria and Egypt. M. Poincaré expressed his desire to effect a reconciliation with the Vatican. These circumstances produced a Cabinet crisis and Poincaré offered to resign in November. President Doumergue refused to accept his resignation; the four Radicals in the Cabinet were dropped and a new ministry was formed.

During 1928 friction between the French and German elements in Alsace and Lorraine continued to disturb the provinces. Agitation for autonomy led to the arrest and trial of 15 Alsatian autonomists at Kolmar (Colmar). Four were sentenced to imprisonment and exile, of whom three were later pardoned by the President. An attempt was made (December, 1928) to assassinate State Attorney Fachot, who led the prosecution. On January 13 and 20, 1929, by-elections were held in Alsace for two representatives, and both seats were captured by autonomist candidates. In the Chamber, M. Poincaré announced that the *status quo* would be maintained in Alsace-Lorraine, and no discrimination made against the German language.

An interesting commemoration of an historic event was observed on February 23, 1929, at four o'clock in the afternoon, to celebrate that day and moment, five hundred years ago, when Joan of Arc set out on horseback from Vaucouleurs for Chinon on the first stage of her tragic adventure. All the church bells in the department of the Meuse burst into peals—most of them the same bells that the Maid of Orleans had herself listened to; in 1929 they again rang out, first in solemn dirge, rising in crescendo to joyful triumph, and fading away in mournful wailing. The first of 400 memorial stones was laid at Vaucouleurs in that hour, to mark the beginning of the trail and the halting-places ending at the stake in Rouen.

Statistics published in May-June, 1929, by the Government revealed that the pitted battlefields continued to exact toll of life and limb. In the area once occupied by the enemy, no fewer than 2,545 persons had been killed or injured by unexploded shells scattered over the terrain, during ten years after the war. Among the victims were large numbers of children and tourists, the latter seeking 'mementoes.' Thousands of men had been employed for years picking up these relics of conflict. In those areas where the ground had been rendered unfit for any further use through bombardment, the Government proposed to create 'red zone parks' to be maintained as permanent reminders to future generations of the futile destructiveness of war. By 1929 all the other battle areas had been cleaned up, rebuilt, and populated by almost the same number as had dwelt there before the war.

In July, 1929, the Chamber passed the Government measure for the payments of war debts to the United States and Great Britain. Though no reservations were attached, the accompanying debates clearly indicated the existence of a mental reservation that French payments to the two former allies would depend upon the size and regularity of German Reparations received by France. Having attained this outstanding object of his policies—that France should honor her obligations—M. Poincaré resigned July 27, 1929, on account of his health, broken by many years of uninterrupted labor.

At the invitation of President Doumergue, Foreign Minister Aristide Briand accepted the premiership—for the eleventh time in twenty years, and received a vote of confidence on July 31, by 324 votes to 126. A conference at The Hague had been called for August to bring about the final liquidation of the financial results of the war—to consider the Young Plan of February-May, 1929. In Great Britain a Labor Government was in power, and it was feared in France that the British Laborites were not imbued with such friendly sentiments towards France as had marked the Conservative and Liberal administrations.

As a private member of Parliament, Philip Snowden, a rather extreme radical Laborite, had violently condemned what he considered the excessive generosity of Great Britain and the heavy sacrifices she had to make by misplaced leniency. Now, in August, 1929, Snowden came to the conference at The Hague as the British Chancellor of the Exchequer, clothed in plenary power to speak in the name of the British Empire. Nor did he fail to express the strong feeling of injustice among the British people over the cut in the percentage of German reparations agreed upon at the Spa Conference, which gave Great Britain about $11,520,000 less annually than she was entitled to. Pessimism reigned in France over what was believed to be a break in the friendly relations with Great Britain; matters brightened a little when Snowden declared that he was no enemy of France, but merely demanded fair treatment for his own country. When a compromise was arrived at by the end of August, Briand had lost not a little sympathy at home. His administration was defeated in October and he was succeeded by M. André Tardieu, who immediately appointed Briand his Foreign Minister.

During 1929 death claimed two distinguished sons of France, the old World War Premier Georges Clemenceau, 'The Tiger,' and Marshal Foch, Generalissimo of the Allied Forces on the Western Front, who, appointed to that high and responsible position at a moment when the Allied cause hovered on the brink of disaster, directed the

greatest fighting machine in all history and snatched victory from defeat.

The Naval Disarmament Conference opened at London in January, 1930, where Tardieu and Briand attended as the representatives of France. See NAVAL DISARMAMENT CONFERENCE. Among the five greatest naval Powers assembled, agreements arrived at were limited to only three—United States, Great Britain and Japan; between the other two, France and Italy, the Conference revived an unfortunate controversy which lasted for several years afterward without any settlement. While Premier Tardieu was pleading the cause of France in London, his Government at home was overthrown February 17, by a hostile vote in the Chamber. M. Camille Chautemps, leader of the Socialist-Radicals, took his place.

Under the many political parties which flourish in France, the life of a government is invariably a precarious tenure, and so it was proved once again by the fall of the Tardieu Ministry after a brief existence of 107 days. Within three days Chautemps had formed his new ministry; on the fourth day it faced the Chamber for the first time, was bitterly attacked by the opposition, and also went down in defeat. This was the 19th government France had had since the World War, making the average life of each about seven months. Tardieu was recalled to the helm, resuming office with a slightly modified list of Cabinet members, among whom Briand figured again as Foreign Minister (March 2). The Chamber only met on June 3 and was cavalierly (but constitutionally) prorogued on July 11, 1930. The opposition attack on his 'personal' policy during the recess met with scant popular response. The three months' vacation at least assured a lease of life to the Tardieu Ministry until October.

In July the French Social Insurance Act came into force, a measure which would affect from eight to nine million working people and their families, applying to both men and women between 16 and 60. When they can no longer work, they will be entitled to a small allowance. There are included in the scheme a comprehensive system of sick benefits and medical care for mothers until six months after childbirth, while all participants are insured at death, the amount being paid to widows or heirs, while there is also a small provision for unemployment. A bill for this measure was first introduced in 1921, passed by the Chamber in 1924, and approved by the Senate in 1927. It was officially promulgated on April 5, 1928, promised in 1929 to take effect on February 5, 1930, and finally forced through by Premier Tardieu.

In September, 1929, M. Briand had broached to the League of Nations his plan for a 'United States of Europe'; in May, 1930, he submitted the plan to all European nations. Europe in 1914 had 26 customs barriers and 13 monetary systems. The War resulted in creating 3,750 miles of new frontiers and brought up the total (including the old ones) to 35 customs barriers and 27 monetary systems. The Briand plan was intended to remove this anomalous confusion, so detrimental to trade and intercourse. In their replies, those nations which had been deprived of territories by the Treaty of Versailles, demanded first a revision of that treaty. The Young Plan also came in for its share of criticism, while the opposition in France declared Briand a 'traitor.'

When the Parliamentary session reopened in the late Autumn, a series of financial scandals disquieted public opinion and led to condemnation of Tardieu's policy (December 4) in the Senate; a vote of 'no confidence' was carried by a majority of three and Tardieu was out with his Cabinet. Another was formed after a nine days' interregnum by M. Steeg. The new Ministry narrowly escaped defeat in its first encounter with the Chamber, and Parliament was prorogued. Relations with Italy were still unsatisfactory at the time, though an undertaking by France to lay down no new keels before the end of the year temporarily relieved the situation. Marshal Joffre, French generalissimo in the war, died Jan. 3, 1931, at 78.

The period from Jan. 1, 1931, to the end of August, 1933, witnessed profound changes in both the domestic condition and foreign relations of France. The developments of fundamental significance were: (1) The extension of the world economic depression to France, the last of the great industrial nations to suffer its rigors; (2) the triumph of the Left in the French parliamentary elections of 1932; (3) repeated clashes between the French and United States Governments on questions of both foreign and domestic policy; and (4) the triumph of the Hitler movement in Germany.

Hardships imposed by the world depression and political and economic developments elsewhere in Europe and the United States were the main factors affecting French politics during the period. There were five Cabinet changes during these years. The Steeg Ministry, composed of representatives of the Left and Centre parties, with the Left predominant, collapsed on Jan. 22, 1931, hardly a month after it was established. No consequential issues were involved. The Cabinet was but another victim of the delicate balance between the parties of the Right and Left which resulted from the elections of 1928. The Steeg Ministry was followed by another Cabinet of the Right and Centre, headed by Senator Pierre Laval (Jan. 27, 1931). M. Laval held office, with one Cabinet reorganization, until Feb. 16, 1932. For France and for all Europe this was a momentous period, marked by repeated crises. Among the problems M. Laval faced were the Austro-German Customs Union project, the European financial crisis, the Hoover Moratorium, the Hoover-Laval conversations in Washington, and the forced resignation of the Brüning Government in Germany, presaging the collapse of the German Republic.

The Laval Ministry strove to check the economic debacle in France by securing an appropriation of $140,000,000 for public works. It adopted a policy, continued by its successors, of imposing import quotas, as well as surtaxes on imports from countries with depreciated currencies, in order to protect French industry. It intervened to save the railways and the French Line, a transatlantic shipping concern, advancing a credit of $12,000,000 to the latter and taking over a majority of the shares of the company. The Government fought the Austro-German Customs Union proposal with all the financial and political weapons at its command and forced both the German and Austrian Governments to renounce it on September 2.

France helped to precipitate the financial crisis of 1931 by withdrawing her short-term credits from Germany and Austria upon the announcement of the *Anschluss* proposal. Impregnable behind a huge gold reserve, the Laval Government withstood the financial storm as it swept from Austria to Germany and on to Great Britain, the Scandinavian countries, Central Europe, and finally the United States.

The French were angered by President Hoover's failure to consult them before making his proposal of June 20, 1931, for

France

a year's moratorium on all intergovernmental debt payments. They withheld consent to the moratorium until changes had been incorporated safeguarding the Young Plan (July 6). Meanwhile the delay nullified much of the psychological effect of the Hoover proposal in checking the economic collapse of Germany. The German crisis continued. Chancellor Brüning sought a $500,000,000 long-term loan in Paris to stabilize the German financial position, but the French demanded political guarantees which the Germans were unwilling to give. While refusing aid to Germany, the French Government authorized large French private and public loans to Poland and the Little Entente (Czechoslovakia, Rumania, and Yugoslavia), its allies in Eastern and Central Europe.

During Oct. 22–27, 1931, Premier Laval visited the United States to confer with President Hoover regarding reparations, war debts, disarmament, and the economic rehabilitation of Europe. He reached an understanding with Mr. Hoover on the following points: (1) Maintenance of the gold standard in France and the United States; (2) that the initiative in any further proposals regarding reparations and intergovernmental debts should be taken at an early date by the European powers principally concerned within the limits of the Young Plan and the Versailles Treaty; and (3) that the 1932 Disarmament Conference should concern itself with 'the organization of firm foundations of permanent peace.'

Upon the resignation of Briand as Foreign Minister and the death of Minister of War Maginot, the Laval Ministry resigned Jan. 7, 1932. M. Laval returned to office at the head of a reconstructed Cabinet of the same political color, but was defeated in the Senate February 16, on the issue of the Government's electoral reform bill. André Tardieu was now called upon and on February 23, formed his third Ministry from the Right and Centre. His short tenure of office (Feb. 23–May 10, 1932) coincided with the quadrennial parliamentary campaign. It was notable chiefly for the failure of his proposal of Mar. 1, 1932, for a Danubian tariff union to permit the economic rehabilitation of Central Europe.

Tardieu's program failed to satisfy the demand for more constructive policies or to calm French fears over the growth of Hitlerism in Germany, the steady economic deterioration of Europe, and the mounting budget deficit. In the elections to the Chamber of Deputies held May 1 and 8, the Left parties won a decisive victory. They captured 376 seats, against 146 for the Centre and 74 for the Right. Of the Left groups, the Radical Socialists made the greatest gains. They increased their representation from 124 to 160; the Socialists, from 100 to 131. Tardieu's Left Republicans, a Centre group, held only 38 of their previous 64 seats. The Republican-Democratic Union, of the Right, retained only 48 out of 102 seats formerly held. In the midst of the campaign (May 6, 1932) President Paul Doumer was shot and fatally wounded by Paul Gorgouloff, a demented Russian. Both Houses of parliament met in joint session at Versailles May 10 and elected Albert Lebrun, president of the Senate, as M. Doumer's successor.

Repudiated at the polls, M. Tardieu resigned on May 10, 1932. He was succeeded by the Radical Socialist leader, Edouard Herriot, who formed a strong Ministry of the Left on June 4, with members of his own party filling 13 of the 18 posts. M. Herriot vigorously attacked the many difficult problems confronting him. At the Lausanne Reparations Conference (June 16–July 8, 1932) he agreed to the practical cancellation of Germany's reparation obligations, on condition that the agreement would not be ratified until France had secured a reduction in her war debt to the United States. See Reparations and War Debts. He re-established the entente with Great Britain through the Anglo-French accord signed at Lausanne. With regard to disarmament, he presented a new French plan to the Disarmament Conference Bureau (Nov. 3, 1932). It called for the extension of the Locarno pacts and for definite aid to a country attacked in violation of the League Covenant and the Kellogg-Briand Pact. Later, at Geneva (Dec. 11), he signed a declaration admitting Germany's right to arms equality 'in a system which would provide security for all nations.'

Herriot's other moves in the foreign field were equally bold departures from previous French policies. He secured the ratification of the Franco-Soviet non-aggression pact, inaugurating a period of greatly improved relations between these two previously hostile powers. He ended Tardieu's tacit support of Japanese aggression in Manchuria and joined with the League powers and with the United States in refusing to recognize Manchukuo. His support of the Kellogg-Briand Pact in Manchuria and of the Hoover disarmament proposals at Geneva led to better relations with the United States. But the ground thus gained was lost by the revival of the war-debt controversy toward the end of 1932. Herriot also made conciliatory gestures toward Italy and resumed negotiations for a Franco-Italian naval agreement. He visited Madrid (Oct. 31, 1932) and conferred with the leaders of the Spanish Republic on mutual problems. Internally, new budget economies and a $3,400,000,000 conversion loan were carried through.

Herriot sought to round out his conciliatory and forward-looking foreign policy by making the highly controversial war-debt payment of $19,261,432 due the United States Government on Dec. 15, 1932, subject to the understanding that France would pay nothing further until a general settlement of the war-debt issue was reached. The Chamber of Deputies, by rejecting his proposal, 402 to 187, on December 14, forced Herriot to resign.

The Radical-Socialist leader declined President Lebrun's invitation to form a new Cabinet. The task was finally delegated to Senator Joseph Paul-Boncour, who on Dec. 18, 1932, formed another Ministry of the Left. It lasted only until Jan. 28, 1933, when its budget proposals were overwhelmingly rejected. Another Leftist Ministry, formed February 2 by Edouard Daladier, seemed destined for an equally short life, due to the critical aspect of the budget situation. It was June 1 before the budget for the calendar year 1933 was finally adopted. In the meantime, Premier Daladier, by his tact and patience in a trying situation, had firmly entrenched his Ministry in power and appeared to have supplanted Herriot as the strongest political figure in France.

At the invitation of President Roosevelt, M. Herriot visited Washington Apr. 23–28, representing the French Government, and discussed with the President mutual Franco-American problems, particularly the forthcoming World Economic Conference. They reached no agreement upon war debts. Their joint statement outlined a tentative program for the economic conference. France again defaulted on her war-debt payment due June 15, 1933. At the World Economic Conference,

which opened June 12, at London, France led a bloc of nations still on the gold standard. They successfully opposed the consideration of tariffs and other items on the agenda, demanding that the United States, Great Britain and other non-gold countries must first agree to end fluctuations in the exchange value of their currencies and return to the gold standard. When the Conference adjourned indefinitely in July, a permanent organization of the gold countries was formed under French leadership to preserve the gold standard.

Meanwhile the excesses of the Hitler Government in Germany had alienated the friends and sympathizers which Germany had gained during the previous decade and relieved French fears of being isolated diplomatically. The bloc of powers which had demanded revision of the Versailles Treaty, including Germany, Italy, Austria, Hungary, Bulgaria, and at one time the Soviet Union, was completely wrecked. The Austrian Socialists and Catholics were antagonized by the Nazi program and Italy was alarmed at the prospect of a greater Germany touching Italy's borders. The acceptance by Premier Daladier of Mussolini's four-power pact (including Italy, Germany, France and Great Britain) to insure the peace of Europe for ten years led to a noticeable improvement in Franco-Italian relations.

A long-forgotten controversy came to life again in 1931 over Clipperton Island (q. v.), when the King of Italy decided the ownership of that island in favor of France, as against Mexico. The affair was submitted to the King's arbitration in 1908. Possession of the island was disputed mainly because of its position on the trade routes followed through the Panama Canal toward the Pacific archipelagoes and its possible value in the future as an aviation base. France claimed it in 1858, but in 1897 some Americans occupied it, and this act, though protected by France, was repudiated by Washington. On the withdrawal of the Americans a Mexican gunboat landed troops and opposed the French claim.

This desire of France to secure potential bases in the Pacific was exemplified again in 1933, when it was announced that the French government had asserted sovereign rights over the Spratly Islands, a group west of Palawan in the Philippine Archipelago. The Spratlys had been visited for many years by Japanese for guano, and by them the islands had been designated Shinnan Gunto; they comprise Amboina Cay, Itu-Aba, the Deux Isles group, Loaita and Thi-tu, with dependent islets.

At the commencement of the abortive London Economic Conference in the summer of 1933 France had, in common with other nations, agreed to the terms of a tariff truce, but in her case, as in that of a majority of her associates, it soon was found impossible to adhere to its terms. Therefore, when, October 12, she announced that she was unable to continue to abide by its provisions, she was but following an example already set by other nations. This action was succeeded in January, 1934, by renunciation of the most-favored-nation status accorded to Germany with respect to imports into France, and when her trade treaty with Switzerland lapsed she declined to renew it.

The unstable situation of successive French governments prevented them from giving to industrial affairs that attention which they warranted, for each ministry, as it went into office, realized the moral certainty that it would fall again before it had had time to take any really effective steps. This lack of continuity of policy naturally proved a most effective brake upon the efforts of leaders of industry, who realized it was futile to embark upon long-term projects requiring governmental coöperation. This condition was primarily the fault of the politicians, who were ready, for party ends, to put the best interests of the country into the background and to render the efforts of all cabinets practically futile. Particularly noticeable was this among the members of the Chamber Finance Commission and of the Foreign Relations Commission of both Houses. In these instances, the numerous factions were so set upon securing political advantages for themselves that they practically nullified the efforts of every ministry, with whatever high ideals, to do anything for the country.

Once more was this exemplified in October, 1933, when the budget for 1934 again was brought up for discussion. With a prospective deficit of $337,500,000 it became imperative for Daladier to propose new schemes of taxation, but the Socialists, hounded on by clamoring, workless supporters, refused to listen to any such proposals, with the result that the premier, bowing to the inevitable, relinquished his office once more, and the President was confronted with the task of finding someone willing to form what was to be the thirty-first government in France since the World War.

Albert Sarraut again stepped into the breach to see what could be accomplished, and on October 27 he formed a ministry which, it was hoped, would be acceptable to all parties. But his proposals were just as unpalatable as those of his predecessor, and when he ventured to suggest that the budget might be balanced through a reduction in the salaries of public servants he was quickly given his marching orders. He went out of office within a month, and on November 27 Camille Chautemps, who had been his minister of the Interior, formed a ministry including four former premiers which hoped, or at least endeavored, to please all parties in the emergency facing the nation.

The credit of the country was at its lowest ebb since the World War; money was flowing abroad at the rate of 700,000,000 francs a week; trade was declining, extremist elements were daily gathering strength and the outlook was gloomy. It became evident, even to the most recalcitrant, that the inevitable could be postponed no longer, that money had to be found and that all sections of the community would have to do their share in finding it. Accordingly, when Chautemps put forward again the proposals for additional taxation all round, for civil service cuts and for other measures which had proved the downfall of his predecessors, he gained the assent of the Chamber on December 11 and of the Senate the following week. The Legislature, before going into recess, moreover, voted provisional twelfths to provide for the expenses of government during the first few months of the new year, and sanctioned flotation of a loan of 10,000,000,000 francs for reduction of the floating debt and to provide for the financing of the government.

The year closed with the entire nation mourning the disaster on the Est Railway near Lagny on Dec. 23, when 200 persons lost their lives and over 300 were injured. The heavy casualties were attributed, in large measure, to the antiquated inflammable rolling-stock in use, and officials of the line were charged with failure to modernize it in accordance with long-standing instructions of the Ministry of Public Works.

Less than three weeks after this calamity the country was once more saddened when the *Emerald*, pride of the long-distance air services, crashed in France on her homeward journey from the Far East. Among

France

the eleven passengers who lost their lives on this occasion was M. Pasquier, Governor-General of French Indo-China, who had been called back to France on urgent business.

These tragic events, however, only momentarily diverted the attention of the nation from the 'affaire Stavisky,' a financial scandal of the first magnitude which threatened to involve many of the highest and most respected in the land. It was learned, December 30, 1933, that Alexander Stavisky, a Russian financial adventurer in France, had absconded with the proceeds of the issue of some 400,000,000 francs' worth of spurious bonds of the municipal pawnshop at Bayonne, of which he had been the director.

The impact of this news was far-reaching. Following discovery of his hideout at Chamonix, in the Alps, January 9, 1934, Stavisky shot and mortally wounded himself as the police sought admittance, and from that moment a public clamor arose which threatened to involve even the stability of the Third Republic. The names of premiers and other statesmen, of judges, of highly-placed officials were bandied about freely as those of men who had been directly interested in the illicit proceedings of Stavisky, and public indignation rose into uproar as succeeding weeks saw more honored names besmirched and sinister mysteries develop.

An inter-parliamentary commission of 44 members sat for weeks trying to unravel the intricacies of the case, and while their proceedings continued the dramatic news was received of the discovery of the body of Judge Albert Prince, who had given evidence in the case, stabbed and tied on the railroad lines near Dijon after a fake telephone message had lured him from Paris. This sensation was followed by the suicide or attempted suicide of several allegedly implicated in the 'affaire,' by the dismissal of high officials from their posts and by the arrest of a score of others who were believed to know more than they were willing to tell.

Inevitably, these proceedings had their repercussions upon the government, which found itself mercilessly assailed from every quarter for the alleged implication of its members in the scandal, for its fancied unwillingness to take effective steps to investigate and, beyond a doubt, as a means for the populace to express its dissatisfaction with the condition into which the country had fallen.

M. Chautemps could not weather the storm. Riots in the streets, turmoil in the Chamber of Deputies, dissensions in his cabinet, made continued tenure of office impossible, and consequently, January 27, he imposed once more upon the President the duty of seeking another to form a ministry. Again the mantle descended upon Edouard Daladier who, January 30, formed a cabinet which promised to have some measure of stability. This hope, however, was short-lived. Daladier attempted heroic measures. He peremptorily dismissed from office Jean Chiappe, popular Prefect of the Paris Police, demanded the resignation of M. Pressard, Chief Attorney-General and brother-in-law of M. Chautemps, and swept a round dozen other highly-placed officials from their posts.

When the new cabinet met the Chamber for the first time, February 6, 1934, there ensued such an outbreak of civil strife that the whole fabric of organized government appeared to be threatened. Uproar among the legislators rendered parliamentary proceedings farcical, and when the Chamber adjourned, such rioting broke out in the streets that troops opened fire, 17 persons losing their lives and over 600 wounded. The next day it became clear that the government was still-born, and the speedy resignation of Daladier was the inevitable outcome. President Lebrun had great difficulty in securing a leader whom more than a handful of the populace would follow, and it was only after personal appeals from politicians of all shades that former President Gaston Doumergue consented to emerge from his retirement and to attempt to do the seeming impossible.

With the innovation, in France, of an absolutely free hand, Doumergue formed a truly coalition cabinet (Feb. 8) which included, besides half-a-dozen ex-premiers, Marshal Pétain, popular defender of Verdun in 1917. This 'National Union' ministry, although opposed by extremist elements from time to time, managed to retain the confidence of the majority in the Legislature and, as a consequence, it was able to achieve much of what its predecessors had attempted. Wide powers were accorded to the government to secure economies by decree, and little time was lost thereafter in reducing pensions and salaries. Authority was given to it, also, to amend existing tariffs by decree, and thence schedules were promptly revised. A loan was raised for re-equipment of the postal telegraph service, and when assurances of an absolutely stable currency had been given the outward flow of francs from the country ceased.

A parliamentary Commission which had been considering reforms in the Constitution recommended, in May, that the President should have the power, if necessary, to dissolve the Chamber of Deputies without prior assent of the Senate, provided it had been in session not less than three months. Further, it suggested that only the government should have the right to introduce financial measures.

However fierce might have been the 'family squabbles' in French domestic political affairs, one fact stood out for all the world to see, and that was the nearly-unanimous intention of the nation to ignore all thought of disarmament and to spend without stint as much as might be necessary for armaments, regardless of budgetary deficits and an empty Treasury. In June, 1934, when Premier Doumergue sought legislative sanction for the expenditure of more than three billion francs for the navy, the air force and fortifications, he declared he had twice seen France invaded by the same aggressor and that 'this was not the time for philosophical digressions.' And his political opponents, echoing his words, gladly gave him all he sought.

This unanimity had only been equalled, in recent months, when the United States was informed, a week or two earlier, that France still could not see her way to resume payment of war debt installments under existing circumstances. A considerable measure of American opinion failed to appreciate the French viewpoint, that perennial anxiety bred of bitter experience.

In order to discuss in Paris the settlement of differences with neighboring countries, King Alexander of Yugoslavia arrived in Marseilles on Oct. 9, 1934. There he was met by Louis Barthou, the Foreign Minister, and while they were driving to the railroad station both were assassinated by Petrus Kalemen, a crazed Croatian from Zagreb. Plans for a Franco-Italo-Yugoslav understanding were indefinitely postponed, and the troubles of the Doumergue government were aggravated.

A crisis was reached when the Premier insisted that Parliament be asked to vote provisional credits for governmental expenses in the first three months of 1935. The six Radical Socialist members of his Cabinet resigned on Nov. 8 and perforce his Ministry fell, to be succeeded by one led by the moderate

France

Pierre-Étienne Flandin. The new Cabinet was well received by the Chamber of Deputies, and despite deepening economic crisis it appeared at the close of 1934 that the most serious troubles of the country were passing away. By a change in the governorship of the Bank of France the Premier initiated development of an easy-money policy, and a bill was introduced in Parliament in January, 1935, for the organization and regulation of industrial production. Since the World War France had had the sole right to work the coal mines of the Saar Basin for a period of 15 years, but on Jan. 13, 1935, the inhabitants voted to rejoin Germany, and accordingly on March 1 the territory was restored to the Reich by the League of Nations, under whose administration it had been.

Although M. Flandin had promised a government of action he in fact accomplished little, and the economic state of the country steadily grew worse. Early in May, 1935, an outward flow of capital commenced and the Premier appealed to Parliament for a free hand to check the impending crisis. Instead he encountered a crushing vote of no confidence on May 31 and accordingly resigned, and late that same day Fernand Bouisson formed a new government. The latter requested from the Chamber of Deputies the right to govern by decree, and when that was denied on June 4 he, too, resigned and France was once more without a government. A new Cabinet was created on June 7 with Pierre Laval as Premier, and after it had been given extraordinary powers to cope with the serious economic difficulties the country settled down to a period of relative calm.

Laval managed to retain office until the close of the year, but rising unemployment and the state of government finances made his administration increasingly unpopular. The Radical Socialist members of his Cabinet resigned on Jan. 18, 1936, and four days later the Premier gave up the struggle and was succeeded by Albert Sarraut. The latter's government of the Left was regarded as merely a temporary stopgap, but on Feb. 27 it was able to secure approval of the Franco-Soviet pact of mutual assistance and soon turned its attention to domestic problems. In December, 1935, the Laval government had succeeded in forcing passage of legislation for dissolution of 'all associations having the character of combat or private militias,' and early in the following year Sarraut disbanded by decree the Royalist Camelots du Roi and the Rightist militant organizations known as the Croix de Feu, Solidarité Française, Jeunesses Patriotes and Francists. The foreign policy of the government became extremely unpopular, particularly with regard to its handling of the Italo-Ethiopian dispute (see ETHIOPIA), and that fact, coupled with the continued burden of inflation and unemployment, proved its downfall.

On June 4, 1936, Sarraut resigned and a new Ministry was formed by Léon Blum, the veteran Socialist. One of the first steps taken was to 'democratize the Bank of France,' in July Parliament voting to place it under a Council of Administration headed by a governor and two vice-governors appointed by the government. In October four large airplane factories were taken over by the government, initiating a program of nationalizing essential war industries, and in March, 1937, Schneider-Creusot, France's largest arms firm, was expropriated. Once more, however, a French government was to fall. Premier Blum found himself faced with another of the ever-recurring financial crises, and because of the multiplicity of political parties striving for tactical advantage at the expense of the State no sufficient number would combine to help him to carry on. In order to stop speculation against the franc he sought emergency powers from Parliament, and following refusal by the Senate on June 21 he resigned.

A new Ministry was formed by Camille Chautemps, the Radical Socialist, and Georges Bonnet, his Finance Minister, acted promptly but ineffectually to check the panic. Payments in gold were suspended and the Bourse was closed; the franc was cut adrift from gold content limitations; and new taxes were imposed. By October the franc had dropped to the new low of 3.28 cents in American money as contrasted with its stabilized value of more than six cents. The difficulties of the government continued, and by the close of the year the steady flow of capital was endangering the very fabric of the Republic.

The Communists resented the conservatism of the Premier, and following the refusal of employers to negotiate their chronic disputes with labor leaders Chautemps resigned on Jan. 14, 1938. Georges Bonnet attempted to form a Cabinet, but he failed, and four days later M. Chautemps again became head of the government, though without coöperation of the Socialists and Communists.

A law went into effect on Feb. 19 extending the civil rights of women and removing from the civil marriage service the word 'obey.' Chautemps' second ministry was admittedly merely a makeshift, and on March 13 it gave way to one formed by Léon Blum of members of the Popular Front. Parliament refused the new Premier dictatorial financial power the following month and he resigned, to be succeeded on April 10 by Edouard Daladier, head of the Radical Socialists. Granted the authority denied to his predecessor, Daladier issued a series of decrees tending toward economic recovery and raised all State direct and indirect taxes 8 per cent. With a new credit for national defense he increased the military and air forces and put in hand construction of more naval vessels, and after fixing the minimum rate for the franc at 2.79 American cents he succeeded in converting a large sum in foreign moneys and holdings at the new low figure.

The French pledge to preserve the territorial integrity of Czecho-Slovakia nearly involved the country in war against Germany in September, but Daladier, in collaboration with Prime Minister Chamberlain of Great Britain, met Hitler and Mussolini in Munich on Sept. 29 and agreed to German occupation of Sudetenland. In November France concluded an agreement with Germany not to resort to war in the event of disputes and to respect existing mutual frontiers, thus ensuring the status of Alsace-Lorraine as French territory. Nevertheless the war clouds were not dissipated, and in December the Daladier government drafted a Three-Year Plan of 'economic mobilization,' suspending the 40-hour week, imposing still more taxes and by other decree measures stimulating armaments and industrial production.

As the year 1939 progressed France became more and more concerned with the international situation. Collapse of the Republican régime in Spain compelled the French government to act as unwilling host to about half-a-million refugees (see SPAIN); the Italians wanted to annex Tunisia and the French Somaliland port of Jibuti (whence ran the French-owned railroad to Addis Ababa) and to have some measure of control of the Suez Canal; and Hitler demanded the return of Danzig and rights within the Polish Corridor. In April France joined with Great Britain in guarantee-

ing Greece and Rumania against attack, and followed this by an alliance with Poland, an understanding with Turkey and overtures to Soviet Russia.

On March 18, 1939, Daladier received from parliament full powers to govern France by decree. Labor regulations, new taxes, further arms expenditures, and governmental economics were voted on April 21. On July 29, the Chamber assented to Daladier's proposal to postpone the national elections of 1940. News of the Soviet-German Nonaggression Pact of August resulted in condemnation and suppression of the Communist Party. When German armies invaded Poland on Sept. 1, the French joined the British in demanding immediate cessation of aggression by Germany and withdrawal of its troops from Poland. On Sept. 3 France was at war with Germany. Immediate war measures were introduced to organize and integrate all national resources. An economic accord between France and Britain united the economic systems of the two countries for the war. Until the spring of 1940 there was a stalemate on the Western Front, but the great German drive of May and June crushed all French resistance, and on June 24 an armistice went into effect between Germany and France, and Italy and France. Reynaud, who had replaced Daladier as Premier of France in March 1940, gave way to the soldier Petain who directed the armistice. Petain received power to dissolve parliament and to draw up a new constitution based upon the principles of 'Labor, Family, and Country.' Former leaders of the Republic were tried for neglect of duty and treason to the State.

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France: Language and Literature. It is customary to begin an account of French literature with the so-called epic period. French epic poetry may be divided into three cycles. The title *chansons de geste* properly belong to the first series of epic poems, which are largely concerned with the wars of Charles Martel and his grandson Charlemagne. The *chansons de geste,* as we know them, were the work of the trouvères of the eleventh and twelfth centuries. They are written in decasyllabic verse, and assonance is used. Two kinds of *chansons de geste* are to be noted—(1) those which deal with the sentiment of loyalty to the king, and (2) those which are inspired by feudalism. To the first class belongs the *Chanson de Roland,* the most celebrated of the *chansons de geste,* and one of the most ancient, dating from the second half of the eleventh century. An analysis of the poem and a quotation might be useful. In 778 Charlemagne, having failed to take Saragossa, was recrossing the Pyrenees. His rearguard was destroyed by the Gascons, and Roland, warden of the Brittany marches, was slain. Legend transformed these simple facts into a great defeat, in which Roland and his peers are surprised by an army of 400,000 men in the valley of Roncevaux, and after performing prodigies of valor are slain. The traitor of the tale (there is always a traitor in such tales) is called Ganelon. Roland refuses to take the advice of his comrade in arms, Olivier, to blow his horn in order to recall the retreating emperor. At last he does so, but it is too late. Then he tries to break his sword Durandal, but cannot; and then

'Sur l'herbe verte s'i est culchiez adenz
Desuz lui met s'espée e l'oilifant,
Turnat sa teste vers la paiene gent
Pur ço l'ad faie qui il vocit veirement
Que Charles diet e trestute sa gent
Lie gentïly quens qu'il fut morz conquérant.'

In modern French prose the foregoing would run: 'Il s'est couché face contre terre sur l'herbe verte. Il met son épée et son cor sur lui et tourna sa tête vers le peuple paien. Il a fait ceci parce qu'il veut vraiment que Charles dise a tout son peuple que le gentil comte mourut en vainqueur.' We can see here how much nearer the parent Latin stem the language is. Further back the resemblance is greater still.

The Breton poems are quite different from the French ones. Even in the middle ages they received the same as *fiction* as opposed to the quasi-historical *chansons de geste.* The Celtic legends cluster round the name of Arthur. It was not till 1170 that they were put into French metrical form by Chrestien de Troyes. The third form of epic poetry was written by ecclesiastics, and is pseudo-classical in theme. The most famous of those poems is the *Roman d'Alexandre,* by Lambert le Tors and Alexandre de Bernay. It is written in 'Alexandrines,' and the subject is mainly taken from Quintus Curtius. It belongs to the twelfth century.

From the epic period we pass to the lyric. It is usually thought that French lyric poetry came from the troubadours of the south, but this is not so. It was not till the middle of the twelfth century that the Provençal influence made itself felt. The chief merit of old French songs lies in their form and their sentiment. Colin Musset is a wandering minstrel, who sings a wandering minstrel's lay. The metrical forms used by these trouvères, as they were called in the north, and troubadours in the south, were many and intricate. It was well for French poetry that their work perished—

France

or, rather, it was bound to perish as soon as genuine inspiration and passion sought utterance in verse. The modern cult for those elaborate and futile forms is mainly confined to Britain; in France they have long since ceased to be used, except by inferior poets.

Another form of literature much in vogue during the middle ages was *les fabliaux*. The larger proportion of these came from the East, but some are of pure French origin. In one of them, *Le Vilain Mire* (*mire* = *médecin*, we find the original of Molière's *Médicin Malgré Lui*. Originally the *fabliaux* were prose improvisations; then they were put into verse, and during the 13th century were in great favor with the *bourgeoisie*. The Palais Royal farce is the lineal descendant of the *fabliau*. Besides *fabliaux* there were satires written in various forms. The most famous writer of satire was Rutebœuf (fl. 1255–80). Then there were the Æsopian fables and the fables of Phædrus and Babrius. But during the middle ages all fables were supposed to come from Æsop, and a collection of them was called an *ysopet*. The most ancient *ysopet* was composed in England in the reign of Henry II. by Marie de France. The most famous, however, was the *Roman du Renart*. The French version we possess dates from the end of the 12th century. It is a parody of the *chansons de geste*, and is the first appearance of the *esprit bourgeois* in French literature.

Didactic poetry finds a representative in Guillaume de Lorris (fl. 1236.) He wrote the first part of the celebrated *Roman de la Rose*, the second part of which was written forty years afterwards by Jean de Meung. The two parts are totally distinct in inspiration. The first is entirely an amorous allegory; the second is full of satire and shrewd observations about life and society. The poem was hugely successful, and remained so during the 16th century, thanks to an edition of it made by Clément Marot in 1527. There is one great book which sums up the mystic piety of the middle ages and which is perhaps the work of a Frenchman. This is the *Imitatio Christi*. The book is popularly ascribed to Thomas à Kempis, but some ascribe it to Jean Gerson (1363–1429).

Let us now cast a glance at historical writing. The monasteries had kept going a sort of chronicles, written in Latin; but a certain Mathieu de Vendôme, in the reign of Louis IX., translated them into French, under the title of *Grandes Chroniques de Saint Denis*, and presented the book to Philippe le Hardi. They reach down to the reign of Louis XI. History proper, however, does not begin till the appearance of Villehardouin's *Conquête de Constantinople* (1207). This work has value, written as it was by a great noble who had taken a prominent part in the fourth crusade. Vigor and sobriety are perhaps the leading characteristics of the work. Next in order we have Joinville's *Histoire de St. Louis*, written in 1309 at the solicitation of Jeanne de Navarre, wife of Philippe le Bel. The chief merit of his book is in its perfect simplicity. After Joinville we come to Froissart's *Chroniques*, which possess something of the charm of Herodotus in their variety, color, and abundance. The period which he treats extends from 1326 to 1400. After Froissart we have Philippe de Commines (*c.* 1445–1511). With him begins political history, and to him we owe the picture of the crafty Louis XI. Besides historians we have also story-tellers and translators. The prettiest novel of the middle ages is *Aucassin et Nicolette*, written in the 13th century; the most noteworthy translation, that of a part of Aristotle by Oresme in the 14th.

We now pass to the drama. In France, as in Greece, religion was its mother. Originally the church was the theatre, but by the 12th century the action of the religious play spread into the street. The 13th century has left us two miracle plays—*Le Jeu de St. Nicolas*, by Jean Bodel of Arras, and *Le Miracle de Théophile*, by Rutebœuf. The 14th century gives us the miracle plays of *Notre Dame;* but it is not till the 15th century that the drama finds its full expression in what are called *mystères*, or rather *mistères*. These may be grouped in three divisions: (1) the Old Testament cycle; (2) the New Testament cycle; and (3) the saints' cycle. They were wholly religious in inspiration. All the personages of Scripture from God to the devil were introduced, and also abstractions such as Justice and Peace. The *mistères* continued to be acted till 1548.

The most ancient French comedy is called *Le Jeu de la Feuillée*, and was written by Adam de la Halle, the hunchback of Arras, about the year 1260. Little is known about the origins of French comedy. Some think that, like tragedy, it took its rise from the *fête des fous* and the *fête de l'âne* which was held in the church. In the 14th century there were formed regular societies for the performance of *farces, moralités*, and *sotie*s. Such were *Les Enfants sans Souci* and *Les Clercs de la Basoche*. The most famous farce of the 15th century is that of *L'Avocat Pathelin*, the authorship of which is disputed. The greatest lyrical poet of the 15th century in France was, without doubt, François Villon (1431–89?) His *Grand Testament* contains some of the loveliest poetry ever written. We all know his *Ballade des Dames du Temps Jadis* from the admirable translation made of it by Rossetti.

With the 16th century we reach the renaissance and the reform, and the first great name in French literature we meet with is that of Clément Marot (?1497–1544). His best work is to be found in his *Epîtres*, which are full of wit and charm.

In 1549 appeared a remarkable manifesto called *Deffence et Illustration de la Langue Française*. Its author, Joachim De Bellay, was one of that constellation known as *La Pléiade*, whose brightest star was Ronsard. The aim of Du Bellay's book was to persuade French poets to imitate the poets of Greece and Rome,and to break with the past literature of France. Their motto was *Odi profanum vulgus*. Ronsard (1524–85) published his first volume of verse in 1550. Its success was immediate and immense. Unfortunately for his reputation, he tried to write an epic poem, and produced the *Franciade* (1572), which is only epic in name. He is a considerable poet, and did much for French versification. His contemporary, Du Bellay, was also a good poet, having much in him of that *douceur angevine* of which he speaks. His best poem is *Les Regrets*—a poem written in Rome. Du Bartas (1544–90), a Protestant, and a disciple of Ronsard, wrote a poem called *La Semaine*, in which he sings about the creation. Its merit, perhaps, is that it found some favor in the eyes of Goethe. To Frenchmen it is unreadable. *Les Tragiques* of D'Aubigné are much in the same case.

The 16th century took a new departure in drama. Jodelle wrote his *Cléopatre* (1552). This play is the first French tragedy in the specific sense of the term. It is a free imitation of Latin antiquity, Seneca being the model. It was Garnier (1545–1601), however, in his *Les Juives*, who founded the 'classical' style. Jodelle also wrote the first French comedy, *Eugène;* but though a comedy in form, it is really only a farce in feeling. Larivey (1540–1611) came nearer comedy, as Molière understood it.

Bulking hugely among the writers of the 16th century stands Rabelais (?1495–1553). Gargantua, Pantagruel, Panurge, Picrochole, Triboulet, La dive Bouteille, L'Abbaye de Thélème,

are words to conjure with for some people whose love of ideas is stronger than their literary judgment. Rabelais, who is misrepresented when he is called *Le Joyeux Curé de Meudon*, sums up in his personality and writings the spirit of the renaissance struggling to free itself from the discipline of the church. The popular conception of him as a drunkard and buffoon with gleams of wisdom is perfectly erroneous. He was a hard-working scholar, a diplomat, and a reformer. The best qualities of his style are its *verve* and richness. He is French of the French, his very exuberance of obscenity being an essentially French quality. What most annoys one in his style is his love of grotesque neologisms and his catalogues. Perhaps, however, the worst offence of Rabelais is that he created a host of imitators, among whom we may reckon Sterne in *Tristram Shandy*.

Another remarkable name of that epoch is Margaret of Angoulême, queen of Navarre, sister of François I. Her *Heptaméron* is an avowed imitation of the *Decameron* of Boccaccio; but it has qualities of its own. Another great book of the 16th century is the *Institution Chrétienne* of Calvin (1509–64). Its interest lies in this, that it brought theological discussion out of the schools and made it accessible to the 'man in the street.' As a piece of literature it is not worth much—if, indeed, it can be called literature at all—but as writing it takes high rank. So does *La Satire Ménippée* (1594), the bare mention of which is sufficient. Amyot's (1513–93) translation of Plutarch is a work of great merit, and is almost a French classic. Henri Estienne (1532–98), of the great family of the Estienne, in his *Traits de la Conformité du Français avec le Grec*, did good service to the language in protecting it against the invasion of Italian words. Montluc (1503–77) and Brantôme (1527–1614) wrote memoirs, both of them amusing.

The greatest prose writer of the 16th century in France is, without doubt, Montaigne (1533–92). His essays are a mine of useful and useless information—always charming and interesting. He is one of the most readable of writers, and one of the most read. He is the most amiable of moralists, in that he has no prejudices, and is quite willing to try things by their results. His scepticism is universal and complete, his motto being 'Que sais-je?' The leading characteristic of Montaigne is his immense and insatiable curiosity, which led him to the conviction that human nature is too *ondoyante et diverse* for any one to dare to dogmatize about it.

The 17th century is usually called the great century of French literature, and in some ways, no doubt, it merits the name. In it literature all round reached a high level of excellence, except in the case of lyric poetry. Malherbe (1555–1628), in spite of his pretensions, is not a lyric poet to be placed alongside Ronsard, although he ranks high as a reformer of language. His boast was to have 'dégasconné la cour,' and to him it is customary to refer as the greatest authority on all questions of poetical usage and language. His aim was to clear poets from the influence of Spain and Italy, and also from the affectations of the imitators of Ronsard. In this he succeeded but too well, and for two centuries French poetry remained bound in his chains, till it was released by Victor Hugo. Not but that Malherbe found dissidents. Mathurin Régnier (1573–1613) protested against the hard and fast rules of the reformer, and advised the poet to 'laisser aller sa plume où la verve l'emporte.' But the ideas of Malherbe, afterwards warmly espoused by Boileau, won the day. Everything tended to their success—the unifying sovereignty of Louis XIV., the labors of the grammarian Vaugelas, and the existence of the Academy (founded 1635). As Malherbe was the reformer of French verse, so Balzac (1597–1654) was the reformer of French prose. He was called in his day *l'unique éloquent*, and although, like Malherbe, he was deficient in ideas, he paved the way for Bossuet. One cannot pass the 17th century without making mention of the famous *salons*, first among which comes L'Hôtel de Rambouillet (1620–48), founded by the marchioness of that name. The influence of these *salons* was very great. Men of letters there met men of rank and ladies of high birth and breeding. The result was that the standard of literary taste was raised, and indecency and coarseness had to veil themselves. The influence of *les précieuses*, as they were called, was not by any means an unmixed evil.

The three great names in the dramatic literature of the 17th century are Corneille, Racine, and Molière, and of these the most interesting and important is Molière. French tragedy is not a lucky product of the national genius. It suffers greatly in comparison with Greek tragedy on the one hand, and English on the other. Neither Corneille nor Racine can be for a moment put near Sophocles or Shakespeare. But Molière stands unrivalled in his own domain, that of satirical comedy. At the beginning of the century the theatre was not a fully popular institution, but was confined to a select circle. With Alexandre Hardy (1560–1631) it became an amusement for all classes. This prolific writer produced some seven hundred pieces, of which forty have come down to us. They are worthless as literature, but interesting as showing what the taste of the public was. Tragedies in the later sense of the word they are not; for none of the so-called unities are observed, the scene shifting from Rome to Athens, and the time sometimes lasting twenty years. Their chief quality is movement—a quality which was lost for two centuries to French tragedy.

Corneille (1606–84) produced his first play (*Mélite*, a comedy) in Paris (1629). Richelieu took him under his protection, and made him collaborate with him in the production of dramatic pieces. But Corneille was not docile enough for the great cardinal, and was dismissed with the criticism that he had no *esprit de suite*. A year afterwards he produced the *Cid* (1636), which took Paris by storm. Never in the annals of the drama was play so successful. After the *Cid* came *Horace*, *Cinna*, and *Polyeucte*, the last being probably his *chef d'œuvre*. The characteristic qualities of Corneille's plays are grandeur and heroism—qualities which afterwards degenerated into harshness and stiffness.

Racine's (1639–99) first piece, *Les Frères Ennemis*, was produced in 1664. In 1667 he brought out *Andromaque*, which was immensely successful. Then came *Les Plaideurs* (a comedy), *Britannicus*, *Bérénice*, *Bajazet*, *Mithridate*, *Iphigénie*, and *Phèdre*. In 1677 he renounced writing for the stage. Twelve years later he wrote *Esther* at the request of Madame de Maintenon. It was performed by the young ladies of her aristocratic school at St. Cyr. In 1691 he produced his masterpiece, *Athalie*, which fell flat.

Molière (1622–73), whose real name was Jean-Baptiste Poquelin, started a company in conjunction with the Béjart family. In 1659 appeared *Les Précieuses Ridicules*, and from that date onwards his pieces followed in rapid succession. Some of his plays are among the masterpieces of Europe—*e.g. Le Misanthrope*, *Tartuffe*, *L'Avare*. Time, which has dimmed the lustre of French tragedy, has left Molière untouched. The French spirit (if there be such a specific entity) found full expression in him. His mental attitude with regard to religion and morals has always been the attitude of the French *bourgeoisie*—more inclined to discover hypocrisy than to share enthusiasm. Religious hypocrisy

stands forever pilloried in the person of Tartuffe. Like most French writers for the stage, Molière tended to create types of virtues and vices rather than concrete personalties. As Tartuffe is the typical hypocrite, so is Harpagon the typical miser and Alceste the typical misanthrope. In *Les Femmes Savantes* the 'blue-stocking' has been pitilessly ridiculed. Everything in character that offended against good sense was hateful to Molière. He never hints at any higher criterion. He is full of wit and shrewd observation of life. His last play, *Le Malade Imaginaire*, was written in 1673.

La Fontaine (1621–95) is a writer who will probably always be more thought of in France than elsewhere. There are certain writers whom fully to like one must be in temperamental sympathy with the nation that produces them. Racine and La Fontaine are conspicuous examples of this, and perhaps, in a later day, Alfred de Musset. And it is just because of their Frenchness, if one may say so, that these writers are more intimately loved and admired in France than others whom even their fellow-countrymen would admit to be greater. The beasts in La Fontaine's fables are so very French, so clever, so witty, that they almost cease to be animals. They are men and women masquerading in fur. Our Anglo-Saxon fabulists, on the other hand, tend rather to represent their animals as children. There is a vein of true poetry, however, in La Fontaine, as one can easily discern if one reads, for example, *Le Chêne et le Roseau*.

The 17th century in France is rich in three classes of writers—*viz.* moralists, writers of memoirs, and writers of sermons. Among moralists, besides Rabelais and Montaigne (who are both really pagan), we have that remarkable writer Pascal (1623–62). It is usual to regard Pascal as a mighty genius, and this conception will probably die hard. His thoughts on religion were highly esteemed by controversialists, but they are in reality the sublime ravings of a scientific mind that has gone mad with terror, and are thoroughly alien to the better religious spirit. His *Provincial Letters* (1656) are usually spoken of as having given a death-blow to the Jesuits. Facts seem to belie this; but it is certain that there is a deal of hard hitting in those wordy epistles.

Descartes (1596–1650) is the philospher whose thought dominates all the 17th century in France. His famous *Discours sur la Méthode* (1637) formed the philosophic basis for the art and literature of the reign of Louis XIV. The celebrated 'Cogito, ergo sum,' is the watchword of the age—an age of lofty characters and narrow intellects. For the first time, metaphysic flung her scholastic robes away, and consented to be *simplex munditiis*. She could now be understood by anybody of ordinary intelligence. The *Discours* was widely read, and Cartesians became as common as evolutionists are nowadays.

Among the writers of *mémoires* the name of Cardinal de Retz (1614–79) stands prominent. Though a prince of the church, he had, as he himself confesses, 'l'âme la moins ecclésiastique de l'univers.' La Rochefoucauld (1613–80) relates the events that happened between 1624 and 1652. One can trace in these memoirs the spirit of the man who was afterwards to write the famous maxims. His experience of men and affairs during the Fronde was fully calculated to make him believe that *amour propre* was the basis of all human action. Among the memoir writers of the age must be mentioned Madame de Motteville (1621–89), Mdlle. de Montpensier (1627–93), and Madame de Sévigné.

The three great French preachers of the reign of Louis XIV. are Bossuet, Bourdaloue, and Massillon. Bossuet's (1627–1704) was perhaps one of the most powerful and healthy of minds. His work is lacking in depth and charm, but he is the past-master of the 'bow-wow' style. Energy and theological good sense are his most striking characteristics. His chief work is *L'Histoire des Variations des Eglises Protestantes*. Bourdaloue (1632–1704) and Massillon (1663–1742) have only left sermons.

The second half of the 17th century had produced new forms of literary art, and it only remained to theorize them. This task was undertaken by Boileau (1636–1711), who assumed the name of Despréaux, and became the friend of Racine and Molière. In 1660 he wrote his first satire. From 1669–74 he composed most of his *Epistles*, his *Art Poétique*, and the first four cantos of his *Lutrin*. In 1684 he became an Academician. Boileau excels in literary satire. As he himself says, he had 'dès quinze ans la haine d'un sot livre.' The principle for which he stands is what Horace calls the *limæ labor*, and in this he is the heir of Malherbe. He is also the heir of Malherbe in his fondness for the *mot propre*. His *chef-d'œuvre* is his *Art Poétique*. In it he lays down the principle of an immutable and impersonal criterion in poetry. Reason, and not imagination, is the guiding genius, and fidelity to nature is the aim. 'Rien n'est beau que le vrai, le vrai seul est aimable.' In the great quarrel of the ancients and the moderns, Boileau was on the side of the ancients, although his real knowledge of the ancients was not very great. His literary doctrines were held sacred for more than a century.

Towards the end of the reign of Louis XIV. there are three writers who mark a period of transition. These are Fénelon, La Bruyère, and Saint-Simon. Fénelon (1651–1715) became archbishop of Cambrai. There he wrote his book, *L'Explication des Maximes des Saints*, which roused the famous quarrel about quietism. *Télémaque* was written for the benefit of his pupil, the Duke of Burgundy. Jean de la Bruyère (1645–96) is a mediocre moralist, but an admirable portrait-painter. He is perhaps the first French writer whom one may call a 'stylist.' His famous work, *Les Caractères*, appeared in 1688. He had a clear perception of the tendencies of his age, although he had not the penetration of a La Rochefoucauld. Montesquieu in his *Lettres Persanes*, and Le Sage in his *Gil Blas*, both derived their inspiration from La Bruyère. Saint-Simon (1675–1755) is perhaps the most astounding writer of memoirs that ever lived. The violence and vigor of his portraiture of people he hated positively make one gasp. His *Mémoires*, which he began to write when he was twenty-one, are full of the most interesting and valuable information, but their literary value is greater than their historical.

With the 18th century a new spirit came into existence. The literature of the preceding age has dealt mainly with man considered as an individual; the 18th century began to consider society as a whole. Science and foreign ideas began to make themselves felt. After the effervescence of the 16th century came the stately pause of the reign of Louis XIV.; but with the 18th century began again the struggle against authority which culminated in the great revolution. As before, the influence of *salons* makes itself felt. La Duchesse du Maine, la Marquise de Lambert, Madame Geoffrin, Madame du Deffand, Mademoiselle de Lespinasse—these ladies all had *salons*, each differing in kind from the other. Fontenelle (1657–1757) was the great *bel esprit* of the day. His best-known work, *Entretiens sur la Pluralité des Mondes* (1686), is an epoch-making book. It is the first attempt at what the French call *vulgarisation*.

Bayle (1647–1706) represents the connecting link between Montaigne and Voltaire. His famous *Dictionnaire* (1695) was the fore-

runner of Diderot's *Encyclopédie*. The name which dominates all others in the 18th century is Voltaire. It is difficult for us now to understand the all but universal sovereignty which he exercised over the intelligence of Europe. There is not one single book of Voltaire's that is really in the first rank. His plays are merely unreadable, and his historical works—admirable as they are in some ways—are desperately dry-as-dust. In fact, Voltaire is perhaps the greatest example of the irony of literary fate. Hailed by his contemporaries as a god and tasting to the full the sweets of glory, he has left nothing behind him that is likely to endure, except one thing, and that is his name. He did a vast amount of work, and was the most indefatigable foe that the spirit of superstition and ecclesiasticism ever found. His written work lies dead, but it was deadly. The church in France never really recovered from his onslaughts. The great mass of French people are Voltairean to this day. That is surely a remarkable tribute to the extent of his influence.

The tragic theatre of the 18th century need not delay the student long. Crébillon (1674–1762) thought that in *l'horreur tragique* lay the secret of power, but he forgot that silly love intrigues detract from the effect he wished to produce. Of Voltaire's tragedies we have already spoken. On the other hand, comedy flourished though for fifty years writers of comedy restricted themselves to an imitation of Molière. Among these the greatest is Regnard (1655–1709); but Dancourt, Le Sage, Dufresny, Destouches, Piron, and Gresset are distinguished names. In Marivaux (1688–1763) we come to a really original writer. His best works lie between 1730 and 1740—*Le Jeu de l'Amour et du Hasard*, *Les Serments Indiscrets*, *L'Heureux Stratagème*, *Le Legs*, etc. The principal innovation in the work of Marivaux is the importance given to love-making. Another is the fact that all his personages are *honnêtes gens*. This last alone is enough to distinguish him from Regnard. Moreover, he created a style—no mean accomplishment. When one talks of *Marivaudage* one means elegance and delicacy not exempt from over-refinement and preciosity.

With Beaumarchais (1732–99) we return to the Molière conception of comedy. The only innovation in the great master's work is the introduction of political satire. Figaro is the great creation of Beaumarchais. The famous *Barbier de Séville* was produced in 1784, and had enormous success. There are many celebrated bitter sayings in the play against the nobles—*e.g.* 'Ils se sont donné la peine de naître.'

In the forefront of the 18th century stand the names of Montesquieu and Buffon. Montesquieu (1689–1755) made his début in the world of letters with his *Lettres Persanes*. They had a huge success, forming, as they do, a brilliant piece of political satire. His next book, *Considérations sur la Grandeur et la Décadence des Romains* (1734), is the first specimen of a philosophy of history from which theology is excluded. His last book, *L'Esprit des Lois* (1748), is the first one in which jurisprudence enters as matter of literature. His style is curiously broken up, but his thoughts are wonderfully true and accurate.

Buffon (1707–88) performed for natural history what Montesquieu did for jurisprudence. He brought it into literature. His *Histoire Naturelle* appeared in 1749. It is a very eloquent work. In a later book, the *Discours sur le Style*, Buffon defends his conception of literary style. Its chief characteristic is an ordered magnificence.

The *Encyclopédie* formed a sort of centre for the leading minds of the 18th century. Most of the contributors to that famous work were but mediocre writers, with the exception of one, Diderot. Diderot (1713–84) was perhaps the greatest jack-of-all-trades that the world of letters ever knew. Everything was grist that came to his mill; art, letters, morals, philosophy—everything fell under his facile pen.

The name next in importance to Voltaire's is, without doubt, that of J. J. Rousseau (1712–78). He began his literary career with an attack on science and art (*Discours sur les Sciences et les Arts*), which worked such havoc in men's minds with the idea of an *état de nature* which never existed. His novel, *La Nouvelle Héloïse*, made an enormous sensation; and his treatise on education, *Emile* (1762), produced a very wide effect. The same may be said of his *Contrat Social* (1762), which was a powerful factor in the minds of the revolutionaries of 1789. It is customary in Britain at present to despise Rousseau. His *Confessions* have alienated the puritanical, the reticent, and the hypocritical—a large body. His 'state of nature' has alienated the men of science. But the fact remains that this weak and rather mean man was a great power for good in the world, and an incalculable source of literature. Rousseau's best disciple was Bernardin de St. Pierre (1757–1814). English and French critics will never be able to agree over the famous prose idyll, *Paul et Virginie* (1787). The redeeming points about the book are the description of tropical scenery, and the pretty, if somewhat too sentimental, love-making of boy and girl.

An account of the literature of the 18th century in France would not be complete without a reference to three more writers at least. These are Le Sage (1668–1747), L'Abbé Prévost (1697–1763), and André Chénier (1762–94). Le Sage, like Saint-Simon, is a survival into the 18th century of the spirit of the 17th. He is not preoccupied with moral ideas, and is contented with portrait-painting. He may be said to have inaugurated the novel of manners in his famous *Gil Blas*. L'Abbé Prévost may, in like way, be called the creator of the love novel in *Manon Lescaut* (1733). This famous work was almost ignored at the time of its appearance, and it was through his translations of Richardson that Prévost made his name. André Chénier brought into the arid world of 18th-century poetry a breath from ancient Greece.

With the 19th century a renaissance takes place in French literature. We are still too near it to appreciate strictly the place which its great writers hold, but we may divide the century into three main periods. The first is the period of preparation, the period of the empire; the second, from 1820 to 1850, is that of the highest creative activity; and the third is that of reaction against the romantic and lyrical tendencies of the previous period.

The great initiator of literature in the 19th century is Chateaubriand (1768–1848). He represents the religious and romantic reaction against the dry, cold spirit of the preceding age. The dominant quality of this writer is sadness — that melancholy which acquired the name of *le mal du siècle*, and which we find in Goethe and Byron. We find it incarnated in *René* (1802). Chateaubriand's most celebrated work is *Le Génie du Christianisme*—the book which brought into literature the enchantments of the middle ages.

Madame de Staël (1766–1817), on the other hand, represents the continuation of the ideas of the revolution. Her greatest work is *De l'Allemagne* (1810). It was she who first made Germany known in France.

The second period may be said to open with *Les Méditations* of Lamartine (1790–1869). If Chateaubriand wrote the prose of the romantic school, Lamartine wrote the verse. In both writers there are elements of silliness which we find hard nowadays to accept. Lamartine is regarded by many

as the greatest poet France has produced; but if it is so, how far short of first-rate excellence the greatest poetry of France falls! Others would say that the palm belongs to Victor Hugo (1802–85). This astounding writer is perhaps the most complete personification of the 19th century in France. His first work, *Odes et Ballades*, marked him out as a leader in poetry. *Les Orientales* are a date. In *Les Feuilles d'Automne*, *Les Chants du Crépuscule*, *Les Voix Intérieures*, *Les Rayons et les Ombres*, and *Les Contemplations*, the poet enters upon his inheritance. Perhaps the finest part of his work is to be found in *La Légende des Siècles*. His plays are inferior, and his prose works lowest of all. His play *Hernani* (1830) formed the battle-ground of the romanticists and classicists, and gave Théophile Gautier an opportunity for making himself conspicuous. Hugo's novels, *Notre Dame de Paris*, *Les Misérables*, and *Les Travailleurs de la Mer* contain fine passages. He had few ideas, and these mostly commonplace; but his sense of form was astonishing, and though much of his work is already dead, much will remain. He is certainly the greatest French epic poet.

Although Hugo's is perhaps the greatest name in French poetry, that of Alfred de Musset (1810–57) is one more intimately loved perhaps by most Frenchmen. Although a disciple of Hugo, Musset had a distinct vein of his own; and his best-known work, such as *Les Nuits* and *L'Espoir en Dieu*, is much more classical in tone than romantic. If not a great poet, Musset is at any rate one of the most charming that ever wrote. He has a deep feeling for beauty and a most delicate fancy. Like Hugo, he also wrote prose; and Musset's prose, unlike Hugo's, is among the best in the language. His plays are merely delightful—*e.g.* *Carmosine*. Alfred de Vigny (1797–1863) is one of those poets who have been better appreciated after their death than during their lifetime. His best poems are to be found in a volume called *Destinées*. His guiding mood is a lofty and noble pessimism—not the melancholy of the romanticists, but a philosophic conviction. *La Mort du Loup* is perhaps his best-known poem.

Théophile Gautier (1811–72) it was who stated the famous 'art for art' formula, and no one acted up to it better than he did. Poems were to be like gems, or statues, or pictures. His *Emaux et Camées* exemplifies this theory. But it is as a prose writer that he is chiefly to be remembered. His preface to *Mademoiselle de Maupin* is a masterpiece of criticism.

The 19th century has been great in history: Thierry, Guizot, Thiers, Mignet, Michelet, Renan, Taine, Fustel de Coulanges are all great names. Thierry (1795 – 1856) started French history on a new basis. His masterpiece is probably the *Récits des Temps Mérovingiens*. Guizot (1787–1874) may be said to have created history as a social science based on accurate research. He endeavored to show the reciprocal influence of the individual on society and society on the individual. Thiers (1797–1877) wrote two great works, *L'Histoire de la Révolution Française* and *L'Histoire du Consulat et de l'Empire*. The chief quality of his work is intelligence. He was also wonderfully industrious. He wrote history as a clever business man might. Mignet (1796–1884) was a great generalizer. He wrote the history of the revolution in two volumes. Sobriety and concision are his leading characteristics. Michelet (1798–1874) is perhaps the most poetical writer of French history that ever lived. He has no philosophy of his subject, but he is a mighty magician, and can evoke the past as no other man has done. He has been called the French Carlyle. Renan (1823–92) is perhaps the finest prose writer of the 19th century in France. He was destined for the priesthood, but gave it up because of his inability to accept the dogmas of Christianity. He wrote *Histoire des Origines du Christianisme*, one volume of which (*La Vie de Jésus*) roused a storm in ecclesiastical quarters. His *Histoire du peuple d'Israël* passed with less comment. His style is rich, delicate, strong, and full of charm. His way of regarding religion marks the great change that the spirit of the 19th century brought about. Blind belief and contemptuous unbelief are alike absent. Taine (1828–93) is chiefly a philosopher. He discards metaphysics, and tries to apply the method of the natural sciences to history and literature. In his *Origines de la France Contemporaine* we see his method rigorously applied. He is a strong and interesting writer. Fustel de Coulanges (1830–89) wrote two books, *La Cité Antique* and *L'Histoire des Institutions Politiques de l'Ancienne France*. His aim was to show the continuity and the slow changes of history. His style is admirable for its conciseness, sobriety, and simplicity.

Criticism in the 19th century is best represented by Sainte-Beuve (1804–69). His large and luminous intelligence seemed capable of understanding any writer. His *Portraits Littéraires* and his *Causeries du Lundi* are marvels of critical power. He also wrote an admirable history of Port-Royal and the Jansenist movement.

Among the novelists of the 19th century some great names stand out. Of Hugo we have already spoken. George Sand (1804–76) is one of the greatest woman novelists that ever lived. She passed through three styles —the romantic, the socialistic, and the pastoral. From *Indiana* we reach *La Mare au Diable* by way of *Consuelo*. This last is her best-known novel in Britain. Her most distinguishing quality is 'delightfulness.' Her style is facile, abundant, and immensely pleasant. Her outlook upon life is optimistic, and she is full of mild wisdom and comprehension of men and things. Henry Beyle, *alias* 'Stendhal' (1783–1842), is the first psychological novelist, and a very remarkable writer. His two chief works are *Le Rouge et le Noir* and *La Chartreuse de Parme*. His description of the battle of Waterloo in the last-mentioned work is famous. Prosper Mérimée (1803–79) is chiefly known for his masterpiece *Colomba*, a tale of Corsican vendetta. His style is sober, solid, and brilliant. Balzac (1799–1850) is the greatest master of realistic fiction that France has seen. Like Shakespeare and Molière, he has left a whole gallery of living portraits. He called his work *La Comédie Humaine*. He divided it into categories, each of which contained several books—*Scènes de la Vie Privée*, *Scènes de la Vie de Province*, *Scènes de la Vie Parisienne*, *Scènes de la Vie Politique*, *Scènes de la Vie Militaire*, *Scènes de la Vie de Campagne*, *Etudes Philosophiques*, *Etudes Analytiques*. Like Rabelais, he has admirers whose fervency is almost exclusive. There can be no doubt that admiration for Balzac is sometimes overdone. It is one of the many signs that while beautiful and flawless art leaves us cold, we warm to what is full of genial power. Balzac writes indifferent French, but his characters are instinct with life. He cannot paint fine and noble characters—he then becomes stiff and awkward —but he excels in depicting one in whom some quality has become dominant and tyrannical. His *Père Goriot*—perhaps his masterpiece—shows this admirably. Flaubert (1821–80) combines romanticism and realism. He is, on the whole, perhaps the greatest master of style that France has produced. He carried his ideal of perfection to unparalleled lengths. He suffered from

France

what he himself called *les affres du style*. His two greatest works are *Salammbô*, a Carthaginian romance, and *Madame Bovary*, a story of provincial life.

From Flaubert and Taine there has sprung the 'naturalist' school, of which Zola (1840–1903) is the chief exponent. This school represents an extreme form of realism, deeply tinged with pessimism. Among its members are Alphonse Daudet, Octave Mirbeau, Guy de Maupassant, J. K. Huysmans, and the two brothers who wrote under the pseudonym J. H. Rosny. The Goncourt brothers (Edmond, 1822–96; Jules, 1830–70) represent what may be styled an advanced naturalism, blankly pessimistic and with a decided predilection for the pathologic.

The latter part of the nineteenth and the first part of the twentieth centuries witnessed a reaction against the school of Zola, but the movement, rather than passing away, became blended with other movements, especially the development of the historical and symbolistic novel. Outstanding figures in French literature of this period are Paul Adam (1862–1920), a prolific writer with a wealth of imagination, who passed from naturalism to symbolism; Maurice Barrès (1862–1923), a writer of great ironic power, a strong traditionalist, and an ardent patriot, as evidenced by his *Au service de l'Allemagne* and *Colette Baudoche;* and Paul Bourget (1852–), a society novelist, notable for his skillful dissection of modern types.

Anatole France (1844–1924) is generally considered the leading man of contemporary letters in France; as a master of style he is unexcelled; he was a worshipper of beauty, and in its honor he fashioned his most perfect phrases. Pierre Loti (1850–1923) wrote of exotic love and of the sea; a sensuous dreaminess pervades his work, and his style, though simple, is full of penetrating and suggestive power. Other recent writers of note are Paul and Victor Margueritte; Octave Feuillet; Edouard Rod; Marcel Prévost; René Bazin, a novelist of rustic life; Pierre de Coulevain, author of *Sur la branche;* Marcelle Tinayre, Georges Ohnet, Emile Fabre, Gabriel Hanotaux, and Jules Lemaître.

Romain Rolland, with his ten-volume biographical *Jean-Christophe* (1904–12) has produced, in some respects, the most notable French novel of his generation. Recent poetry finds its chief exponents in Paul Fort, Comtesse de Noailles, Charles Péguy, who died at the front in the Great War, Fernand Divoire, a champion of the most advanced schools, Paul Valery, Maurice Magre, and Francis Carco.

In the dramatic field, among the chief figures of modern French literature are Victorien Sardou (1831–1908), who wrote some sixty plays, ranging from deepest tragedy to sparkling comedy, including *Fedora, La Tosca, Madame Sans-Gêne, Divorçons* and *Rabagas;* Dumas fils (1824–93), whose *La dame aux camelias*, one of the first of the 'problem' plays, has enjoyed immense popularity; Eugene Brieux (1858–), a sincere reformer, broad-minded and earnest, among whose works are *Maternité, Les trois filles de M. Dupont, Simone,* and *La robe rouge;* and Edmond Rostand (1868–1918), the brilliant author of *Cyrano de Bergerac* and *L'Aiglon*. Henry Bernstein (1876–), Henri Bataille (1872–1922), Maurice Dounay (1860–), Pierre Wolff (1865–), and Henri Lavedan (1859–) are also notable dramatists. Paul Hervieu (1857–1917) is the most distinguished writer of tragedy.

In the field of philosophy the name of Henri Bergson stands pre-eminent. His *L'Evolution créatrice* is a full and complete statement of his metaphysical attitude and a shining example of poetic and powerful style.

The Language.—From the language of the Strassburg oaths (843) to that written by Rostand there is an immense way. Daughter of Latin, French has become, from something very like its mother, something that is very different. French was the outgrowth, however, not of the literary Latin of Cicero, but of the colloquial Latin of the Roman settlers in Gaul. There popular Latin falling into the hands of two rival races, one in the north and the other in the south, produced two distinct idioms—that of the south being called the *langue d'oc* (see PROVENÇAL LANGUAGE AND LITERATURE), and that of the north the *langue d'oïl*.

There were in the Middle Ages four principal dialects of the langue d'oïl—Norman, Picard, Burgundian, and, in the centre of the triangle formed by these three, French (the language of the Ile de France). Each of these dialects had its own literature. It was the election of Hugh Capet, duke of France, to be king, making Paris the capital of France, that assured the sovereignty of the dialect of the Ile de France. Gradually the other dialects became mere *patois*, and by the 14th century the transformation was complete.

The tendency to simplify and reduce the number of cases appeared early in popular Latin, because of the failure of the rough barbarians to grasp the more delicate shades of meaning expressed by them. In the 6th century we find only two cases instead of six, *viz.* the nominative and the accusative—*e.g. murus* and *murum*. In the 14th century the nominative case was suppressed in both numbers, and only the accusative retained.

The golden rule in French etymology is the persistency of the stress accent. It has well been called *l'âme du mot*. It always occupies one of two places—either the last syllable, in words with a masculine termination (as *aimer, finir*), or the penultimate, when the ending is feminine (as *roide, voyage*). Here the likeness to Latin is traceable, for in that language, also, the accent has one of two places—penultimate when that syllable is long (as *amare, finire*), the antepenultimate when the penultimate is short (as *rigidus, viaticum*). All words belonging to popular and real French respect the Latin accent; such words as do not are of late and learned origin—e.g. *examen* and *mobile*.

Bibliography.—For a general view of French literature consult Harper's *Masters of French Literature;* Brunetière's *Manual of the History of French French Literature;* Bury's *French Literature of Today;* Doumic's *Contemporary French Novelists;* Dowden's *A History of French Literature;* Hudson's *A Short History of French Literature* (1919); Des Granges' *An Illustrated History of French Literature* (1921); Nitze and Dargan's *A History of French Literature from the Earliest Times to the Great War* (1922); Butter's *A History of French Literature* (1923).

There are large numbers of works—most of them in French—on the various periods. The following are among the best:

MIDDLE AGES: For the *chansons de geste*, consult Léon Gautier's *Les epopées françaises* and Gaston Paris' *Histoire poétique de Charlemagne;* for lyric poetry, Clédat's *La poésie lyrique et satirique en France au moyen age;* for satirical and didactic poetry, Lenient's *La satire en France au moyen age*. For the historians, consult Debidour's *Les chroniquers français* and Gaston Paris' *Extraits des chroniqueurs français;* for the theatre Marius Sepet's *Origines catholiques du théâtre moderne* and Clédat's *Le théâtre au moyen age*.

SIXTEENTH CENTURY: Consult Darmesteter and Hatzfeld's *Le XVIe siècle en France;* Emile Faguet's *Etudes littéraires sur le XVIe siècle* and *La tragédie française au XVIe siècle;* Sainte-Beuve's *Tableau de la poésie fran-*

çaise au XVI^e siècle; Egger's *L'Hellenisme en France;* Emile Chasles' *La comèdie en France au XVI^e siècle;* Lenient's *La satire en France au XVI^e siècle;* Sayous' *Les ecrivains de la réformation;* Tilley's *Studies in the French Renaissance* (1922).

SEVENTEENTH CENTURY: Consult Nisard's *Histoire de la littérature française;* Brunetière's *L'Evolution des genres, Etudes critiques* and *Les époques du théâtre français, 1636–1850;* Gautier's *Les grotesques;* Lemaître's *Corneille et la poétique d'Aristote* and *Impressions de théâtre;* Petit de Julleville's *Histoire du théâtre en France* (3 vols.); Sainte-Beuve's *Port Royal;* Taine's *Essais de critique et d' histoire,* and *Nouveaux essais;* Richards' *Feminist Writers of the Seventeenth Century* (1914); Wright's *French Classicism* (1920).

EIGHTEENTH CENTURY: Consult Villemain's *Tableau de la littérature au XVIII^e siècle;* Faguet's *Le XVIII^e siècle;* Paul Albert's *La littérature française au XVIII^e siècle;* Brunetière's *Histoire et littérature;* Lenient's *La comedie en France au XVIII^e siècle;* Desnoiresterres' *Voltaire et la société au XVIII^e siècle;* Finch and Peers' *The Origins of French Romanticism* (1920).

NINETEENTH AND TWENTIETH CENTURIES: Consult Faguet's *Etudes sur les ecrivains du XIX^e siècle,* and *Politiques et moralistes du XIX^e siècle;* Brunetière's *L'Evolution de la poésie lyrique au XIX^e siècle* and *La roman naturaliste;* Thiers' *Les grands ecrivains français;* Lemaître's *Les contemporains, sixième série;* Pellissier's *Le mouvement littéraire au XIX^e siècle;* Symons, *Colour Studies in Paris* (1918); Turquet-Milnes' *Some Modern French Writers* (1921).

Philological works by the following writers will be found useful: Brachet, Brunot, Diez, Paris, and Littré.

France, ANATOLE (1844–1924), French writer, whose real name was Jacques Anatole Thibault, was born in Paris. He was educated at the College Stanislas and produced his first published work, *Alfred de Vigny,* in 1868. This was followed by *Poèms dorés* in 1873, *Les noces corinthiennes,* a drama in verse, in 1876, and *Jocaste et le chat maigre* in 1879. His first novel, *Le crime de Sylvestre Bonnard,* a charmingly ironical tale, published in 1881, strengthened the foundations of his fame, and his subsequent works, notable both from the point of view of style and of erudition, made him the acknowledged leader of contemporary French letters, famous alike as a critic, a novelist of rare distinction, and a keen and mordant satirist. He was a member of the Legion of Honor and of the French Academy and in 1921 was awarded the Nobel prize in literature. Among his works not already mentioned are *La vie littéraire* (5 vols. 1888–1893); *Thais* (1890); *Opinions de M. l'Abbé Jérôme Coignard* (1893); *Le lys rouge* (1894); *Histoire contemporaine,* a series of four stories (1897–1900), setting forth his own philosophy of life; *Le livre de mon ami* (1905); *L'Ile des pengouins* (1908); *La vie de Jeanne d'Arc* (1908); *Les dieux ont soif* (1912); *La révolte des anges* (1914); *La vie en fleur* (1922). There are English translations of most of his works.

France, ÎLE DE. See MAURITIUS.

Francesca da Rimini, fränches'ka dä rē'mē-nē (?—*c.* 1288), daughter of Guido da Polenta, lord of Ravenna, became the wife of the deformed Gianciotto (Giovanni), the son of Malatesta da Rimini, a leader of the Guelph faction, as a means of bringing about a reconciliation between the two warring families. Paolo, the bridegroom's handsome younger brother, was sent to escort the bride and they fell violently in love. Giovanni surprised the guilty lovers in Francesca's chamber and murdered them both.

Francesco di Paula, fränches'ka dē pou'la (1416–1507), founder of the order of Minims (q. v.), was born in Paula or Paola, in Calabria. His parents dedicated him to St. Francis of Assisi, and at an early age he entered the monastery of San Marco. After living for six years in a cave on the seashore, and gathering about him a band of followers, he built (1435) a chapel and founded the order of Minims (q. v.), formally established by Pope Sixtus IV. in 1474. Many miracles are ascribed to him, and King Louis XI. of France died in his arms. He was canonized by Leo X. in 1519.

Franceville, fränsh-vēl', sometimes called PORTO VILLA, station, French Congo, on a tributary of the Ogowé.

Franche-Comté, fränsh'kôn-tā', former province of France, extending from the Saône to the Jura Mountains. Its ancient name was Comté de Bourgogne.

Franchise, fran'chīz. In English law the terms franchise and liberty are synonymous, meaning a royal privilege in the hands of a subject, such as the right to hold a court, or to have a fair, a market, or a ferry, with the right to take tolls; or to have waifs, wrecks, estrays, treasure-trove, royal fish, and forfeitures, within certain limits; or to have a forest, chase, park, warren, or fishery.

In modern times the most important franchise is the grant of a corporation. By this franchise certain important advantages are enjoyed which are not enjoyed by unincorporated associations of individuals, the chief of which are perpetual succession, and, generally, limited liability. Where such a franchise grants the right to carry on business requiring the use of public roads, streets, etc., it may become an exceedingly valuable form of property. Thus the franchise of a street railway company is often more valuable than its aggregate tangible assets. Such franchises were formerly granted gratuitously, often in perpetuity, or for a period of 999 years. In recent years the public has come to a better realization of the value of franchises, and in many cases demands the limitation of the term of the franchise to twenty or twenty-five years; there is also strong public sentiment in favor of requiring proper compensation to the municipality or state for the privileges enjoyed. Where franchises have been already granted in perpetuity or for an excessively long period, the only possibility of obtaining for the public a share in the profits arising from them is through taxation, since the courts hold that franchises for which any compensation has been made are contracts, and therefore may not be revoked. (See TAXATION.)

Politically, the term franchise indicates the right to vote. (See ELECTIONS.)

Francia, fran'chä, or FRANCESCO RAIBOLINI (1450–1517), Italian painter, was born in Bologna. He was apprenticed to a goldsmith, became famous as a skilled worker in metals, and was director of the Bolognese mint under the Bentivogli. About 1483 he became a warm friend of Lorenzo Costa and resolved to become a painter. His earliest dated work is the *Madonna and Child* in the gallery at Bologna. He painted many other pictures of the Virgin, as well as several portraits and frescoes. He had two sons, Giacomo (1486–1557), and Giulio (1487–1543), the former of whom was a noted painter. The work of the latter is little known apart from that of his brother, with whom he worked.

Francia, JOSÉ GASPAR RODRIGUEZ DE (1757–1840), dictator of Paraguay, was born in Asuncion. It was while practising as a lawyer in Asuncion that he first rose to a position of influence. On the declaration of Paraguayan independence of Spanish rule (1811), Francia obtained a post in the new government, in 1813 became one of the consuls, and on the death of his colleague became sole ruler, eventually as dictator for life. Absolute prohibition of foreign inter-

course, even of a commercial nature, was a feature of his policy. He abolished the Inquisition, and adopted at the same time strong measures for the repression of all religion.

Francillon, fräṅ-sē-yon′, Robbert Edward (1841–1919), English novelist and journalist, was born in Gloucester, was educated at Cambridge, and was admitted to the bar in 1864. He was on the staff of the London Globe from 1872 to 1894. In 1868 his first novel, *Grace Owen's Engagement,* appeared in *Blackwood's Magazine.* Later works are *Pearl and Emerald* (1872); *Olympia* (1874); *A Dog and His Shadow* (1876); *Strange Waters* (1878); *King or Knave* (1888); *Gods and Heroes* (1895); *Mid-Victorian Memories* (1913).

Francis, St., of Assisi (1182–1226), founder of the Franciscan order, was born in Assisi, the son of Pietro Bernardone, a wealthy travelling merchant. As a youth he was one of the leaders among the young nobles of Assisi, and in 1201 took part in a military expedition against Perugia, which resulted in a year's captivity. After his release, when in his twenty-second year, he was attacked by a severe illness. Upon his recovery he found his abounding joy of living gone, and questions concerning the meaning of life and death beginning to agitate his mind.

Casting off his old habits of life, Francis retreated daily into the caves and holes of the rocks to struggle with his soul. At last, the victory won, in his own picturesque language, he chose 'holy poverty' for his bride. His resolution, pursued with a characteristic carelessness of consequences, incurred his father's passionate and not unnatural anger; and after various sorrowful and stormy passages, the parental tie was severed, and the young man dedicated himself to a life of poverty and penance, consecrating himself wholly to the service of Christ. His example was soon followed by others. A rule of life was drawn up enjoining chastity, obedience, and poverty, even to the renunciation of all worldly possessions, and the foundations of the great Franciscan order were laid. The authorization of the new order by Pope Innocent III. was formally granted in 1216; new brethren were received in increasing numbers, and the first chapters of the order—among which that of 1217 was notable—bore testimony to its growing strength, as well as to the unparalleled personal influence of its founder.

In 1219, setting out on a missionary journey to Egypt and Palestine, Francis preached both to the crusading armies and to the inhabitants. Recalled to Italy in 1220, he found that through the efforts of Cardinal Ugolino, and of the two vicars of the order, Matteo di Narni and Gregorio di Napoli, great changes had been effected in regard to multiplication of rules and relaxation of the vow of poverty; while academic learning, which was foreign to the Franciscan principle, was also being encouraged. Francis waged war with inexorable determination against the new tendency, but the fight was an unequal one, and his long struggle with approaching death drew its bitterness less from bodily suffering than from the sorrow of a betrayed ideal and a disappointed hope.

In 1224, occurred the miracle of the stigmata, concerning the authenticity of which much controversy has arisen—Francis receiving, while in an ecstasy of prayer, in the high solitude of Monte Alvernon, the marks on his own body of the wounds of Christ.

He died, two years later, in Assisi, Oct. 3, 1226, and was canonized by Pope Gregory IX. in 1228. His works—including correspondence, sermons, hymns, and other literary remains—were published in 1739. The *Cantico delle Creature* ('Song of Creation') is the most celebrated of his poems. The personality of Francis was a unique one. Mystic, poet, nature lover, one whose courtesy and gayety were the necessary outflow of his mind, his compelling charm is more adequately shown in its effects upon his contemporaries than even by the enthusiasm of his biographers.

Consult Lives by St. Bonaventura, Hase, Paul Sabatier, Mrs. Oliphant, Le Monnier, Cuthbert, and Egan; Butler's *Lives of the Saints;* Herkless' *Francis and Dominic;* Carmichael's *The Lady of Poverty.*

Francis, St., of Sales (1567–1622), Roman Catholic preacher and devotional writer, was born in Sales, near Annecy, France. He entered the priesthood in 1591, and in 1602 became bishop of Geneva. His efforts to reconvert to Catholicism those districts near Geneva which had embraced the reformed faith met with considerable success, though his conferences with Theodore de Beza, the great Protestant leader, had no result. Preaching in Paris in 1602, he won several Huguenot nobles to the Catholic faith. In 1604 he made the acquaintance of Madame de Chantal, who became the first superior of the Ordre de la Visitation, founded by Francis in 1610. A second visit to Paris in 1608 was attended with even more marked success than the first.

The chief literary work of St. Francis of Sales was the *Introduction à la Vie Dévote* (1808; Eng. trans. 1885), which won for him a reputation throughout the whole of Christendom, and is to-day one of the most popular of all Roman Catholic devotional works. It was followed in 1616 by the *Traite de l'amour de Dieu.* Francis was canonized in 1685 by Pope Alexander VII., January 29 being dedicated to him. Consult *Lives* by Hamon, Pérennes, Camus, and Lear.

Francis I. (1494–1547), king of France, was the son of Charles, Count of Angoulême and Louise of Savoy. When twenty years of age he married Claude, daughter of Louis XII., whom he succeeded in 1515. Queen Claude died in 1524, after having borne him seven children, three sons and four daughters, and in 1530 he married Eleanor, sister of Charles V., from whom he lived apart. Immediately upon his accession, Francis undertook to restore Milan, which had been lost to France under Louis XII.; he won a brilliant victory at Marignano (1515), which resulted in an arrangement with the Pope known as the Concordat of Bologna (1516), whereby ecclesiastical appointments in France were to all practical purposes left in the hands of the king. On the death of the German Emperor Maximilian, in 1519, Francis aspired to the Imperial crown, but the election fell to Charles of Austria, who became Charles V. The remainder of Francis' reign was given over to warfare against his successful rival (see France). He suffered a disastrous defeat at Pavia in 1525, was carried captive to Madrid, and after many months of illness and imprisonment signed the humiliating Treaty of Madrid (1526). Upon his return to France, however, he repudiated it and, having enlisted the sympathy of Pope Clement and Henry VIII., again invaded Italy. Rome was sacked by the Imperial forces, the Pope taken captive, a French army which had been sent into Naples was decimated by disease and poverty. The Peace of Cambrai was eventually concluded in 1529, but six years later war broke out afresh (1535), a ten-years' truce was signed at Nice in 1538, but in 1544 Francis again attacked Charles, winning a decisive victory at Ceresola. Peace was concluded at Crespy in 1544.

Francis was a man of charm and distinction, extremely adaptable and of generous impulses, a patron of arts and letters, but frivolous and unscrupulous.

Francis II. (1543–60), king of France, succeeded to the throne on the death of his father (Henry

II.) in 1559, and reigned one year. In 1558 he had married Mary Queen of Scots.

Francis I. (1708–65), Holy Roman emperor (1745–65), was the son of Leopold, Duke of Lorraine, and in 1536 married Maria Theresa of Austria, who succeeded to the Austrian throne in 1740. He was elected Holy Roman Emperor in 1745.

Francis II. (1768–1835), last emperor of the Holy Roman Empire (1792–1806), and first emperor (1804–35) of Austria (as Francis I.), was born in Florence and succeeded his father, the Emperor Leopold II. Immediately upon his accession he became involved in war with France (April 1792), and in 1797 he was forced to sign the peace of Campo Formio, by which Austria ceded to France the Lombard provinces and Flanders, receiving in return Venice and a part of Bavaria. In 1798 Francis embarked upon a second war with France, which was concluded by the peace of Luneville (1801), leaving France in possession of the left bank of the Rhine. In 1804 he assumed the title of Emperor of Austria, and the following year joined England and Russia in a coalition against France. Following Napoleon's victory at Austerlitz (December 1805), Francis abdicated the imperial crown of Germany, and the Holy Roman Empire ceased to exist (1806). In 1809, as Emperor of Austria and King of Bohemia and Hungary, he again entered into war against Napoleon. His forces were victorious at Aspern and Esslingen but were totally defeated at Wagram, and he was forced to sign the peace of Schönbrunn. In 1810 Francis' daughter Maria Louisa was married to Napoleon, and for a time peace was maintained, but in 1814 Austria allied herself with Russia and Prussia against France. Upon the fall of Napoleon she regained much of her lost territory and joined the Holy Alliance, Francis following out Metternich's policy of solicitude for the material welfare of the people and the erroneous one of practically prohibiting commercial intercourse with foreign countries. Francis was an easy-going, good-natured ruler to his subjects, but a man of cruel vindictiveness to his enemies.

Francis, CHARLES SPENCER (1853–1911), American journalist and diplomat, was born in Troy, N. Y., and was graduated from Cornell University in 1877. He learned the printer's trade on the Troy *Times*, published by his father, John M. Francis, and became successively reporter, editor, and manager. In 1887 he became an equal owner of the paper with his father and, upon the latter's death, in 1897, sole proprietor. He was secretary to his father when he was minister to Greece, and from 1903 to 1906 was Regent of the University of the State of New York. He was minister to Greece, Roumania, and Servia in 1900–02, and from 1906 to 1910 was ambassador to Austria-Hungary.

Francis, CONVERS (1795–1863), American clergyman and educator, brother of Lydia Maria Child, was born in West Cambridge, Mass., and was graduated (1815) from Harvard. He studied theology in Cambridge Divinity School, and in 1819 became pastor of the Unitarian Church in Watertown, Mass., retaining his office until 1842, when he was made professor of pulpit eloquence and pastoral care at Harvard. He published *A Life of Rev. John Eliot, the Apostle to the Indians* (1836), in Sparks' 'Library of American Biography,' *Life of Sebastian Rale* (1848), and other biographical studies.

Francis, DAVID ROWLAND (1850–1927), American public official, was born in Richmond, Kentucky. He was graduated from Washington University (1870), and entered a commission house, in which he later became a partner. In 1877 he established a commission and grain firm of which he was president. He was mayor of St. Louis in 1885–9, governor of Missouri in 1889–93, and was made Secretary of the Interior (1896–7) by President Cleveland. From 1916 to 1921 he was Ambassador Extraordinary and Minister Plenipotentiary to Russia.

Francis, JOHN WAKEFIELD (1789–1861), American physician, was born in New York City, of German parentage. He was graduated (1809) from Columbia University, studied medicine with Dr. David Hosack, was his partner until 1820, and with him edited the *American Medical and Philosophical Register* for several years. He was associated (1813–26) with the College of Physicians and Surgeons before and after its incorporation with the Columbia Medical School, and from 1826 to 1830 was a professor at the Rutgers Medical School. He was a prominent member of the New York Historical Society, and often contributed to its publications. Upon the reorganization of the New York Academy of Medicine in 1847, Dr. Francis became its first president. His published works include *Use of Mercury* (1811); *Cases of Morbid Anatomy* (1814); *Letter on Cholera Asphyxia of 1832* (1832); *Old New York, or Reminiscences of the Past Sixty Years* (1857).

Francis, JOSEPH (1801–93), American inventor, was born in Boston, Mass. When a young man he established a boat-yard in New York City, and soon gained a reputation for his rowboats and life-boats, for which he received orders from the U. S. Government. He invented many devices in connection with life-saving apparatus, being the first to make life-boats of iron, with air spaces at bow and stern. His metallic life-car, devised in 1842, was instrumental in saving many lives.

Francis, SIR PHILIP (1740–1818), English public official, reputed author of the *Junius Letters*, was born in Dublin. After holding a junior clerkship under the secretary of state, and two secretaryships, he became first clerk in the War Office (1762). In 1773 he received an appointment on the Council of Bengal, and the next year went to India, where he remained until 1781, becoming meantime a bitter antagonist of Warren Hastings, at whose impeachment he assisted some years later. He was a member of Parliament from 1784 until 1807, when he retired. The *Letters of Junius*, which first appeared in 1768, are said to be the work of his hand, and, although their authorship has never been proved, there is considerable evidence to support the claim. See JUNIUS, LETTERS OF.

Francis'cans, MINORITES, or LESSER BRETHREN, a religious order founded in 1209 by St. Francis of Assisi (q. v.). The regulations prescribed by St. Francis were severe in the extreme, and the members of the order would have been mendicants had they acted up to the founder's stern rule of poverty. Even during the life of St. Francis controversies on this injunction arose, and after his death the relaxations decreed by successive Popes gave rise to various divisions of the order. In 1517 Pope Leo X. recognized two of these divisions, the Observantists and the Conventuals, who, with the Capuchins, originating a few years later, are the survivals of a much more numerous division.

The Observantists, called in France Cordeliers, comprised the most rigid section of the old community, and take first rank among the Franciscans, their minister-general having preëminence. The Conventuals follow the rules of St. Francis with various relaxations. They are independent except that their general has to be confirmed by the minister-general. The Capuchins, founded by Matteo de Bassi, about 1525, have an independent general under the minister-general. They introduced the *capuche* or pointed cowl. They were formally recognized, under

the title of Capuchins of the Order of the Minorites, by Paul III. in 1536. Another branch to which the name of 'Recollects' was given (introduced in Spain by John of Guadalupe in 1500), was approved by Clement VII. in 1532. A further development of the rigoristic spirit is the Congregation of 'Discalced' or 'Barefooted' Franciscans. The Franciscan institute includes also several orders of nuns, which owe their origin to Clare, a noble maiden of Assisi. (See CLARE, ST.)

An important feature of the organization of the Franciscan order, as it subsequently became of other orders, is the enrollment of non-conventual members, who continue to live in society without the obligation of celibacy; and in general are bound only by the spirit, and not the letter, of the rule. They are called 'Tertiaries,' or members of the Third Order of St. Francis.

The Franciscan order in these several branches has at all times maintained its popularity in the Roman Catholic Church, and is still one of the most numerous. Many of the foreign missions are mainly supplied by Franciscans, and they possess convents in almost every part of the world. As a literary order the Franciscans have chiefly been eminent in the theological sciences.

A long array of distinguished theologians and churchmen have belonged to the Franciscan order, including Bonaventura, Alexander of Hales, Duns Scotus, and William of Occam.

Early in the eighteenth century the Franciscans numbered nearly 120,000 friars with 7,000 houses, and some 30,000 nuns, with 900 convents. These numbers are now considerably reduced, but the order remains one of the strongest of the Roman Catholic Church. A recent enumeration showed 1,413 convents and 17,000 friars belonging to the Franciscan order (male), 505 convents and 10,000 nuns of the female orders, and about 2,500,000 members of the Third Order (secular).

Consult Brewer's *Monumenta Franciscana;* Currier's *History of Religious Orders;* Cusack's *St. Francis and the Franciscans;* Herkless' *Francis and Dominic;* MacDonnell's *Sons of Francis.*

Francis Ferdinand, ARCHDUKE, of Austria (1863–1914), nephew of the Emperor Francis Joseph (q. v.), was born in Gratz. He became heir to the thone on the renunciation of the claim by his father, the Archduke Charles Louis, next in succession after the Crown Prince Rudolph, whose death occurred in 1889. At an early age Francis Ferdinand entered the army, and he later rendered valuable service in the military affairs of his country, helping to maintain the unitary character of the joint army of the Dual Monarchy, and introducing important reforms. Politically, he stood for the strengthening of the central government and for a rigorous foreign policy. In 1900 he contracted a morganatic marriage with the daughter of a Bohemian nobleman, Countess Sophie Chotek, who was later created Duchess of Hohenberg. On June 28, 1914, the Archduke and his wife were shot and killed by a Servian sympathizer at Sarajevo, Bosnia, an event which precipitated the Great War of Europe (q. v.). See AUSTRIA, *History.*

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FRANCISCO FRANCO

Francis Joseph I. (1830–1916), emperor of Austria, son of the Archduke Francis (son of Francis I.) and the Archduchess Sophie (daughter of Maximilian I. of Bavaria), was born at Schönbrunn, and succeeded his uncle Ferdinand, who had been forced to abdicate, on Dec. 2, 1848. Ascending the throne at a time when nationalism was the predominant note in Central and Southern Europe, the young Emperor faced serious disaffection in his Hungarian and Italian dominions. With the aid of Russian troops, Hungary was subdued in 1849, and the insurgents in Italy were also put down. Early in 1859 events in Italy again approached a crisis; Austria made war inevitable by calling upon Piedmont to disarm; and aided by the French, the Italians wrested Lombardy from Austria. In 1866 the question of the headship of Germany was decided in favor of Prussia on the field of Sadowa (q. v.); and Austria was, moreover, forced to cede Venetia to

Italy. The Austrian empire being no longer based upon the theory of German ascendency, it was inevitable that the relations of Austria and Hungary should be rearranged. By the famous 'Compromise' an Austro-Hungarian state was formed, and in June, 1867, the Emperor Francis Joseph was crowned at Budapest with the crown of St. Stephen. Thenceforth Francis Joseph set aside the traditional Hapsburg policy of absolutism, and adopted one of conciliation toward the varied nationalities comprised in the empire.

The private life of the Emperor was singularly tragic. In 1854, after a romantic courtship, he was married to Elizabeth, the younger daughter of Maximilian, duke of Bavaria. Four children were born to them—a daughter Sophie (1855), who died at the age of two, the Archduchess Gisella (1856), the Crown Prince Rudolph (1858), and the Archduchess Maria Valeria (1868). In 1867 his brother Maximilian (q. v.) was executed in Mexico; in 1889 the Crown Prince Rudolph committed suicide at Meyerling; and in 1898 the Empress Elizabeth was killed by an Italian anarchist. Another tragedy was the assassination at Sarajevo on June 28, 1914, of the heir-apparent, Archduke Francis Ferdinand (q.v.), and his wife, which plunged most of Europe into war (see EUROPE, GREAT WAR OF). In July, 1916, the Emperor suffered a severe chill while inspecting his troops, and died at Schönbrunn Castle on Nov. 21, toward the close of the sixty-eighth year of his reign.

Consult H. de Weindel's *The Real Francis Joseph* (Eng. trans. by P. W. Sergeant, 1909); H. Rumbold's *Francis Joseph and His Times* (1909); F. Gribble's *The Life of the Emperor Francis Joseph* (1914); R. P. Mahaffy's *Francis Joseph I.* (1915).

Francis of Assisi. See FRANCIS, ST., OF ASSISI.

Francis of Paola. See FRANCESCO DI PAULA.

Francis of Sales. See FRANCIS, ST., OF SALES.

Francis Xavier. See XAVIER.

Franck, fräṅk, ADOLPHE (1809–93), French philosopher, of Jewish descent, was born at Liocourt, Meurthe, and became professor of international law at the Collège de France (1856–86). Among his numerous works are: *La Cabbale ou Philosophie Religieuse des Hébreux* (1843); *Réformateurs et Publicistes de l'Europe* (3 vols., 1863–93); *Eléments de Morale* (7th ed. 1881); *Essais de Critique Philosophique* (1885); *Philosophie du Droit Civil* (1886). He was editor of an important *Dictionnaire des Sciences Philosophiques* (1843–9, 6 vols.), co-editor of the *Journal des Débats*, and editor of the *Paix Sociale*.

Franck, CÉSAR AUGUSTE (1822–90), French musical composer, a native of Liège. He entered the Conservatoire of Paris in 1837, and taught the organ there from 1872. He at once achieved a measure of popularity with the religious cantata *Ruth* (1846); but he met with no very marked recognition until, in 1873, his oratorio *Rédemption* inaugurated a period of increasing fame, which continued until his death. During this period he produced *Les Béatitudes* (1870–80), an oratorio; symphony in D (1889), *Variations Symphoniques*, also other works for orchestra and for piano; songs, including *Les Cloches du Soir;* and the operas *Hulda* and *Ghiselle*, performed after his death. Consult *Lives* in French by Derepas, Baldensperger and D'Indy (Eng. trans. 1909).

Franck, frängk, SEBASTIAN (1499–1542), German writer, one of the earliest masters of German prose, was born at Donauwörth. He incurred, in 1531, the sentence of banishment from Strassburg, where he had settled two years before, because of the freedom and independence of his views, and especially the advocacy of religious toleration expressed in his *Chronica*. He was a printer at Ulm from 1533 to 1539, then at Basel. Of his works, besides the *Chronica*, the most important are a collection of proverbs, *Sprichwörter* (1541); *Paradoxa* (1534); *Weltbuch* (1534), in which is gathered the geographical knowledge of his age; a translation of the *Encomium Moriæ* of Erasmus; and *Germaniæ Chronicon* (1538). He writes in a rich and varied style, at times with telling irony or genial humor, at others in a strain of sadness.

Francke, fräng'ke, AUGUST HERMANN (1663–1727), German philanthropist, was born at Lübeck. In 1692 he obtained the professorship of Oriental languages at Halle, which in 1698 he exchanged for that of theology. A pupil of Spener and the teacher of Zinzendorf, Francke belonged to the ranks of those who carried forward the pietistic movement (see PIETISTS). His activity took the practical direction of founding, endowing, and organizing various educational institutions at Halle; at the time of his death his schools were frequented by more than 2,300 pupils, and they still flourish. His principal aim was to impart religious instruction to poor and neglected children. He founded also a printing office and in addition an apothecary's shop.

Franco, FRANCISCO (1892–), Spanish general and dictator of Spain, leader of insurgent forces in the Spanish Civil War, was born in Galicia. He was made a colonel in 1926 and in 1931 saw service in the Balearic Islands. Made chief of staff in 1935, he was later appointed governor of the Canary Islands. The Civil War (q. v.) broke out in June 1936. Franco flew to Spanish Morocco, there organized native troops, and sent them off to Spain. Franco became head of the insurgent forces upon the death of General Sanjurjo, and in October 1936 was declared to be 'Commander-in-Chief of the Spanish Army' and 'Chief of the Spanish State.' Franco soon associated himself with Adolf Hitler (q. v.) and Benito Mussolini (q. v.), accepting their help. Upon the defeat of the government forces, March 29, 1939, Franco became dictator.

Franco-German War (1870–71). After the overthrow of Austria in 1866 by the Prussian armies, Napoleon III. (q.v.) of France had felt that his country was no longer the leading military power on the Continent. In 1870 the suggestion that a Hohenzollern prince was likely to become king of Spain roused French feeling. Though the Hohenzollern candidature was withdrawn, Benedetti (q. v.), the French ambassador, demanded (July 13) from King William of Prussia (q. v.) at Ems a guarantee that no prince of Hohenzollern would be allowed to accept the crown of Spain. Bismarck published, with certain omissions, a telegram which he received from William, giving an account of the interview; and French public opinion demanded war, which was formally declared by France against Prussia on July 19. Southern Germany joined Prussia, and Austria and Italy maintained neutrality.

The plan of the French Emperor was to cross the Rhine at Maxau, and push his armies between the North and South German states so as to force the latter to remain neutral. Such action required superiority in numbers and mobility at the very outset, besides good generalship. These advantages were soon found to be all on the side of the Germans, whose splendid organization enabled them to complete mobilization by July 30. Their troops, 518,800 men, with 1,584 guns, were then formed into three armies—the first under General Steinmetz, the second under Prince Frederick Charles, and the third under the Crown Prince.

The French had with difficulty collected 270,000 men with 925 guns by the beginning of August, and these were deficient in transport and equipment. Napoleon assumed the chief command, and had 128,000 men between Metz and the frontier at Saarbrücken, some 47,000 under Marshal MacMahon (q. v.) on the eastern slopes of the Vosges Mountains, and 35,000 in reserve at Châlons. The first engagement took place on Aug. 2, when Frossard's corps drove out the German detachment in Saarbrücken; but the Germans took the offensive next day. On Aug. 4 the third army (130,000) on the German left met Douay's advanced brigade (5,000 men) near Weissenburg, defeated him, and pressed on to Wörth, where MacMahon had taken up a strong position with his main body (45,000). The battle fought here on the 6th was disastrous to the French, who fled in confusion through the Vosges Mountains. On the same day the Battle of Spicheren was fought between 67,000 of the first German army and 32,000 of Frossard's corps, and ended in the orderly retreat of the latter.

As a result of these disasters the Emperor found it necessary to retire toward Metz, and after the fierce and undecided rearguard action at Borny on Aug. 14, entered that fortress on the following day with 176,000 men and 540 guns. He then abandoned the chief command to Marshal Bazaine (q. v.). Meanwhile the second German army had reached the Moselle, and was threatening with its advanced troops the roads to Paris. Bazaine attempted to retreat westward, but was stopped by the Germans; and on Aug. 17 he concentrated on the Gravelotte position, eleven miles in extent. On the 18th the pitched battle of Gravelotte was fought, and resulted in the French being driven back on Metz. Here they were surrounded, and, after several gallant but unsuccessful attempts to break out, surrendered on Oct. 27.

Meantime the Gardes Mobiles had been called out, and with the remains of MacMahon's army formed at Châlons a body of 120,000 men, with 324 guns, much disorganized. An attempt to join hands with Bazaine by a northerly march was commenced on Aug. 21; but on the 30th the fifth corps under De Failly was surprised and driven northward on Sedan. Here MacMahon found that the enemy had surrounded him. A fierce battle commenced early on Sept. 2 by an attack on the village of Bazeilles, which was captured by the Bavarians and recaptured by the French, and ultimately burned. By noon MacMahon had been wounded, and General Wimpffen (q. v.) had taken command, only to find further resistance hopeless, in spite of the gallant charges of the French cavalry under General Marguérite, who fell at their head. Nearly 500 guns were playing upon the French, who were crowded into Sedan and under its walls, and at 5 P.M. the white flag was hoisted on the citadel. Next day the Emperor, who was with the army, surrendered with 83,000 men.

The news of Sedan led to a revolution at Paris. The Empress fled, and a government of National Defence was set up under Trochu, Favre, and Gambetta. Before the close of September, Strassburg, one of the last hopes of France, had capitulated. On Sept. 15 the army of the Crown Prince of Prussia arrived before Paris, and the siege of the French capital began. Meanwhile in various parts of France efforts were made to defeat the German armies; but in spite of occasional successes, victory declared itself on the side of the Germans. Metz was surrendered by Bazaine on Oct. 27; and Gen. d'Aurelle de Paladines, after winning a victory at Coulmiers on Nov. 9, was overthrown a few weeks later in a series of battles near Orleans. Bourbaki's attempt to create a diversion by advancing into Germany ended in total failure; while Chanzy's gallant efforts round Le Mans proved insufficient to affect the issue of the war.

From Paris, where almost every able-bodied man was enrolled in the ranks, frequent sorties were made, and bloody battles fought in the villages to the east and south, Le Bourget, Champigny, Le Hay, Bougival, and Raincy, several of which were taken and retaken more than once. The city also underwent a bombardment for several days, from which, however, it suffered little, and it was not until January 1871, after a four months' investment, that negotiations were opened with the enemy at Versailles.

Peace was signed at Frankfort-on-the-Main on May 10, 1871. Alsace-Lorraine, Metz, and Strassburg were ceded by France, and a war indemnity of $1,000,000,000 was imposed on the conquered country, which was occupied by German troops till the money was paid. This enormous obligation was discharged in September, 1873.

See FRANCE, *History;* GERMANY, *History.* Consult Von Moltke's *Franco-German War* (Eng. trans.); F. B. Maurice's *The Franco-German War* (new ed. 1909).

François, fräṅ'swä', commune and port on the east coast of Martinique, West Indies. Pop. (1921) 13,966.

Old Man of the Mountain, Franconia Notch, White Mountains

Fran'colin (*Francolinus*), a genus of birds of the grouse family closely allied to the partridge (q. v.).

Franco'nia. On the break-up of the Carlovingian empire (see CARLOVINGIANS), the East Frank realm, or Austrasia, fell into four divisions, which were known as the duchies of Franconia, Saxony, Bavaria, and Swabia. With the death of the Emperor Conrad I. in 918 the Franconian dynasty ended, and the Saxon line took its place. A hundred years later these national dukedoms became broken up, and there were no longer dukes in Franconia. In 1501, when Maximilian I. divided Germany into circles, he used the

term Franconia to denote a circle which included the bishoprics of Würzburg, Bamberg, and Eichstätt, the abbey of Schönthal, the district of Mergentheim, the principalities of Baireuth and Anspach, and certain imperial towns. After 1806, when the Holy Roman Empire ceased, the term Franconia fell into disuse. At the present time it is represented by the Bavarian divisions of Upper, Middle, and Lower Franconia.

Franconia Notch, a wooded defile in the Franconia Mountains, a western group of the White Mountains. It is 5 miles long, and is traversed by the Pemigewasset River, which passes through a narrow gorge 700 feet in length known as 'the Flume.' At the upper end of the Notch is Profile Mountain (4,114 feet), from the side of which projects the curiously formed ledge known as 'the Old Man of the Mountain.'

Francs-tireurs, frän-tē-rûr' ('free shooters'), armed bands of French peasants and others that sprang into existence during the progress of the Franco-German War. At first their military organization was rudimentary; afterward this defect was in some measure remedied, and they were even formed into regular corps. For the most part they carried on a guerilla warfare, attacking small detachments of the enemy, and cutting off foraging parties.

Franeker, frän'e-ker, town, Netherlands, in the province of Friesland; 11 miles by rail southwest of Leeuwarden. The sixteenth-century town hall contains an eighteenth-century Planetarium, constructed by Eise Eisinga. From 1585 to 1811 Franeker was the seat of a university. Pop. (1920) 7,785.

Frangipani, fran-ji-pan'i, a famous family of the Roman nobility, dates its authentic history from Leo Frangipani in 1014. CENCIO FRANGIPANI was one of the leaders of the Ghibelline party early in the twelfth century. More than a century later GIOVANNI FRANGIPANI, lord of Astura, betrayed Conradin of Swabia to Charles of Anjou (1268). A branch of the family survives in the province of Udine. The Croatian Frangipani are of Slavonic origin, and probably unconnected with the Roman family.

Frang'ula, or ALDER BUCKTHORN (*Rhamnus frangula*), a European shrub, about eight feet in height, with slender stem, and entire obovate leaves, smooth and glossy.

FRANK, GLENN (1887–1940), American editor and educator, was born in Queen City, Mo. After attending the Missouri State Normal School for three years, he was graduated from Northwestern University (1912; M.A., 1921). He served as assistant to the president of Northwestern University (1912–16), and during 1916–19 was associated with Edward A. Filene of Boston in research and organization work. He was made associate editor of the *Century Magazine* in 1919, and editor-in-chief in 1921, resigning in 1925 to become president of the University of Wisconsin, where he remained until 1936. He is the author of *An American Looks at His World* (1923), *America's Hour of Decision* (1934). Dr. Frank served as Editor-in-Chief of the *University of Knowledge* (1938), and in 1940 edited *Rural Progress* until his death.

Frankalmoign, frangk-al-moin', or FREE ALMS, an ancient tenure in England whereby a religious corporation may hold lands under an obligation to perform certain pious or spiritual services. See TENURE.

Frankau, MRS. JULIA. See DANBY, FRANK.

Frankenberg, fräng'ken-ber*ch*, town, Saxony, in the province of Zwickau; 11 miles by rail northeast of Chemnitz. It has textile industries, calico printing, and dyeing. Pop. 12,912.

Frankenhausen, fräng'ken-hou'zen, town, Germany, in the principality of Schwarzburg-Rudolstadt; 12 miles by rail southeast of Nordhausen. Here in 1525 the revolted peasants, led by the Anabaptist Münzer, were defeated by the Saxon and Hessian troops. Pop. 6,500.

Frankenstein, fränk'en-stīn, in the romance of that name, written in 1816–18 by Mrs. Shelley (Mary Godwin) in imitation of the old German stories of the supernatural, is the mortal who, having by the resources of natural science, created a being in the form of man, is tormented by the monster of his own creation. In popular usage the term Frankenstein itself is often inaccurately applied to any creation which proves a cause of anxiety or disaster to its author.

Frankenstein, town, Prussia, in the province of Silesia; 45 miles by rail southwest of Breslau. It has linen and woollen factories and trade in grain. Pop. 9,300.

Frankenthal, fräng'ken-täl, town, Bavaria, Palatinate province; 8 miles northwest of Mannheim, 4 miles west of the Rhine, with which it is connected by canal. It has engineering shops, bell foundries, sugar factories, and breweries. Pop. 22,868.

Frankenwald, fräng'ken-vält, mountainous region of Bavaria, the connecting link between the Thüringer Wald and the Fichtelgebirge. It forms an undulating plateau, with a mean elevation of 2,000 feet. The highest summit is the Brocken (3,745 feet).

Frank'fort, city, Indiana, county seat of Clinton county, on the Chicago, Indianapolis and Louisville, the New York, Chicago and St. Louis, and the Pennsylvania Railroads; 45 miles northwest of Indianapolis. Shops of the New York, Chicago, and St. Louis Railroads are located here and there are manufactures of flour, lumber, cigars, kitchen cabinets, and enamel table tops. Pop. (1900) 7,100; (1910) 8,634; (1920) 11,585.

Frankfort, city, Kentucky, capital of the State and county seat of Franklin county, on both banks of the Kentucky River, here spanned by a suspension bridge, and on the Chesapeake and Ohio, the Frankfort and Cincinnati, and the Louisville and Nashville Railroads; 54 miles east of Louisville. Public buildings are the State House, Governor's Mansion, State Arsenal, and State Penitentiary; educational and charitable institutions include the State Normal School (colored), State Institute for the Feeble Minded, King's Daughters' Hospital, and State Library. Franklin Cemetery, in which Daniel Boone is buried, is a point of interest. Frankfort is a shipping point for the surrounding 'Blue Grass' district, and has manufactures of lumber, furniture, boots and shoes, tobacco, flour, hemp, twine, and glass. It was settled in 1786, and in 1792 became the State capital. Pop. (1900) 9,487; (1910) 10,465; (1920) 9,805; (1940) 11,472.

Frankfort, village, New York, Herkimer county, on the Mohawk River, the Erie Canal, and the West Shore Railroad; 10 miles southeast of Utica. It has manufactures of condensed milk, road machines, tools, and paper. Pop. (1910) 3,303; (1920) 4,198.

Frankfort-on-the-Main (German *Frankfurt-am-Main*), city, Prussia, in the province of Hesse-Nassau, on the right bank of the Main, 22 miles above its confluence with the Rhine and 100 miles southeast of Cologne. It includes the suburb of Sachsenhausen on the left bank, with which it is connected by several bridges.

In the older part of the city, adjacent to the river, many of the buildings and streets retain their mediæval characteristics. Notable features in this section are the house in which Goethe was born, with a Goethe museum attached; the Römer, a group of twelve mediæval houses serving as the town hall, and including the hall in which the German kings were elected and that in which the coronation banquet was held; the cathedral of St. Bartholomew, founded about 870 and rebuilt in the thirteenth and

fourteenth centuries, in which after 1562 the German emperors were crowned; the Saalhof, the oldest building in Frankfort; the old Main bridge on which is a statue of Charlemagne; the Justitia fountain, in the market place, often the scene of popular demonstrations; the house in which Schopenhauer lived; and the ancestral house of the Rothschild family, the sole remaining relic of the Jewish quarter of the city, the famous *Judengasse*.

In the more modern part of Frankfort, lying to the north, are the central railway station, the post office, law courts and opera house. Other features of interest are the Senckenberg National History Museum, the Zoological Gardens, the Städel Institute, with an excellent picture gallery and art collection, and the Palmen-Garten, with fine gardens and hothouses.

Frankfort is a strong financial and commercial centre. Its manufactures include machinery, hats, perfumes, chemicals, and tobacco. Printing and brewing are carried on, and market gardening is important. Two annual fairs attract large numbers of visitors and traders. Pop. (1939) 546,649.

The first historical notice of the town occurs in 793, when it is recorded that Charlemagne spent the winter in the villa Frankonuvard. In 843 it was made the capital of the East Frankish Kingdom, but with the decline of the Carolingian power it became less important. From 1152 to 1806 the German emperors were chosen, and from 1562 crowned, in Frankfort. From 1245 to 1806 it was a free Imperial city. From 1816 to 1866 it was the meeting place of the German Diet and in 1848–9 of the National Assembly. It was incorporated into the Prussian province of Hesse-Nassau in 1866 and five years later was the scene of the signing of the peace treaty ending the Franco-German war. During the difficulties in the Ruhr district, following the Great War, French troops occupied Frankfort from April 6 to May 17, 1920.

Frankfort-on-the-Oder, town, Prussia, in the province of Brandenburg, on the Oder, 50 miles southeast of Berlin. A fine bridge connects it with the suburb of Damm on the opposite bank. Notable features of the city are the town hall (1607–10), the church of St. Mary (15th century), Lienau House, containing art and natural history collections and statues of William I., Heinrich Von Kleist, and Prince Frederick Charles of Prussia. Frankfort is well known for its three fairs, and as a centre of trade with Poland. From 1506 to 1811 it was the seat of a university (now at Breslau). Its industries include the manufacturing of machinery, iron and steel goods, chemicals, and tobacco. Pop. 65,055.

Frankfurter, FELIX (1882–), American jurist, was born in Vienna, Austria. He was brought to the United States in 1894. He received his A.B. degree from the College of the City of New York in 1902, and his LL.B. from Harvard in 1906. From 1906 to 1910 he was assistant United States Attorney for the southern district of New York. He served as law officer for the Bureau of Insular Affairs, Department of War, from 1911 to 1914. His academic career began in 1914 at Harvard University, where he served with high distinction as Professor of Law until 1939. He was frequently called upon to serve as adviser to the Federal Government. Major and Judge Advocate of the Officers' Reserve Corps, Assistant to the Secretary of War, secretary and counsel to the President's Mediation Commission, assistant to the Secretary of Labor, and chairman of War Labor Policies Board, were some of the positions he held. He was appointed Associate Justice of the United States Supreme Court by President Roosevelt January 5, 1939, and took office January 30, 1939. He edited and co-edited collections of significant cases, the most important being *Cases Under the Interstate Commerce Act* (1915), second edition (1922). Justice Frankfurter wrote a number of notable books on legal problems, among them *The Case of Sacco and Vanzetti* (1927), *The Public and Its Government* (1930), and *Mr. Justice Holmes and the Supreme Court* (1939).

Frank'incense (*Olibanum*), a gum resin obtained from *Boswellia carterii*, of the order Burseraceæ, and brought chiefly from Somaliland. It occurs in roundish tears, about half an inch in diameter, colorless to reddish, covered with a white powder; its odor is balsamic, and its taste bitter. It burns with a fragrant odor, and is used in incense, fumigating powders, etc.

Frankl, fräṅ'k'l, LUDWIG AUGUST, VON HOCHWART (1810–94), Austrian poet, of Jewish parentage, was born in Chrast, in Bohemia. He achieved a considerable reputation through his poetical works, among which are *Das Habsburglied* (1832); *Christoforo Colombo* (1836), an epic; *Don Juan d'Austria* (1846); *Tragische Könige* (1876); *Lyrische Gedichte* (5th ed. 1880); *Episches und Lyrisches* (1890); and *Gusle* (1852), a translation of Servian national songs. His poem, *Die Universität*, achieved an unexampled popularity in 1848. His collected poems, with the exception of the *Satires*, were published at Vienna in 1880. In 1856 Frankl visited Jerusalem and established the first modern Jewish school there. His *Nach Jerusalem* (1858) and *Aus Ægypten* (1860) describe conditions as he found them.

Frank'land, SIR EDWARD (1825–99), English chemist, was born in Churchton, near Lancaster. He studied under Bunsen at Marburg, and Liebig at Giessen. Among his contributions to chemical science was the 'Theory of Valency'—*i.e.* the conclusion that each atom of an elementary substance possesses a clearly limited power of saturation, so that only a correspondingly limited number of atoms of other elements can be attached to it. In 1863 he became professor of chemistry at the Royal Institution, London, and in 1865 at the Royal College of Chemistry. His name is associated with that of Sir Norman Lockyer in spectroscopic researches, which resulted in the conclusion that the photosphere of the sun is gaseous. The discovery of helium in the sun was also the result of their joint labors.

Frankland, PERCY FARADAY (1858–), English chemist, was born in London. He was demonstrator and lecturer on chemistry in the Royal School of Mines, London (1880–8), and professor of chemistry in University College, Dundee (1888–94), in the Mason College, Birmingham (1894–1900), and in the University of Birmingham (1900–19). His chemical investigations are chiefly in the domain of stereochemistry. He is also the author of papers dealing with the chemistry and bacteriology of water-supplies and sewage purification. Many of his researches, especially those in bacteriology, were carried out with the collaboration of his wife (see FRANKLAND, MRS. P. F.). Professor Frankland is a Fellow and Vice-President of the Royal Society. He was President of the Institute of Chemistry in 1906 and of the Chemical Society in 1911. He received the Davy Medal of the Royal Society for Chemistry in 1919. Among his publications are *Agricultural Chemical Analysis* (1883); *Our Secret Friends and Foes* (1894); *Micro-organisms in Water* (1894); and *Life of Pasteur* (with Mrs. Frankland, 1897).

Frankland, MRS. PERCY FARADAY, *née* GRACE C. TOYNBEE (1858–), author, bacteriologist, and journalist, wife of Professor P. F. Frankland, was born in Wimbledon. She has done original research in the field of bacteriology and has written *Bacteria in Daily Life* (1903) and numerous papers on microorganisms. She was joint author,

with her husband, of *Micro-organisms in Water* (1894) and *Life of Pasteur* (1897).

Frank'lin, in feudal England the owner of freehold land—*i.e.* land free from the ordinary dues paid to a feudal lord and held direct from the sovereign. At first the position of the franklin corresponded roughly with that of a modern country squire. Later, it seems to have represented rather the yeoman farmer farming his own land.

Franklin, city, Indiana, county seat of Johnson county, on the Cleveland, Cincinnati, Chicago and St. Louis, and the Pennsylvania Railroads; 20 miles south of Indianapolis. It is a residential city and the seat of Franklin College (q. v.) and the State Masonic Home. Corn, cattle, hogs, and poultry are raised extensively in the surrounding district. The city's industries include canneries and manufactures of furniture, galvanized ware, athletic underwear, spaghetti, and flour. Pop. (1910) 4,502; (1920) 4,909.

Franklin, city, Kentucky, county seat of Simpson county, on the Louisville and Nashville Railroad; 134 miles south of Louisville. Industrial establishments include flour, lumber, and tobacco mills. Pop. (1910) 3,063; (1920) 3,154.

Franklin, town, Louisiana, capital of St. Mary Parish, on Bayou Teche, and on the Franklin and Abbeville, the Gulf Coast Lines, and the Southern Pacific Railroads; 90 miles west of New Orleans. It is a shipping centre for lumber, fruits, sugar, and cotton. Pop. (1910) 3,857; (1920) 3,504.

Franklin, town, Massachusetts, Norfolk county, on the New York, New Haven and Hartford Railroad; 28 miles southwest of Boston. Dean Academy and the Ray Memorial Library are situated here. The library was founded by a collection given by Benjamin Franklin, for whom this was the first town to be named. Manufactures include textiles, hats, printing presses, and pianos. Pop. (1910) 5,641; (1920) 6,497.

Franklin, city, New Hampshire, Merrimac county, on the Merrimac River, formed here by the conjunction of the Winnipesaukee and Pemigewasset Rivers, and on the Boston and Maine Railroad; 19 miles northwest of Concord. The State home for orphans is located here. Abundant water power is employed in the manufacture of paper, pulp, woollen goods, hosiery, needles, knitting machines, boxes, and lumber. Franklin was the birthplace of Daniel Webster. Pop. (1910) 6,132; (1920) 6,318.

Franklin, borough, New Jersey, Sussex county, on the Delaware, Lackawanna and Western, the New York, Susquehanna and Western, and the Lehigh and Hudson River Railroads 25 miles northwest of Paterson. Pop. 4,075.

Franklin, village, Ohio, Warren county, on the Big Miami River and Canal, and on the Cincinnati Northern, and the Cleveland, Cincinnati, Chicago and St. Louis Railroads; 35 miles northeast of Cincinnati. The leading industries are the manufacture of paper, roofing, vacuum tubes for radio receiving sets, leggings and overgaiters. Pop. (1910) 2,659; (1920) 3,071.

Franklin, city, Pennsylvania, county seat of Venango county, on the Alleghany River, and on the Erie, the Lake Erie, Franklin and Clarion, the New York Central, and the Pennsylvania Railroads; 70 miles northeast of Pittsburgh. Franklin is situated in the heart of the oil and natural gas region of the State, and is connected by trolley and bus lines with all cities within a radius of 100 miles. The leading industries include the refining of petroleum and the manufacture of oil-well supplies, steam engines, railway supplies, carbon paper, asbestos goods, machine tools, glass, and various products from iron, steel, brass, and tin. Fort Machault, erected here by the French, was completed in 1754 and abandoned five years later. In 1760 the English built Fort Venango, which was destroyed by the Indians in 1763. Fort Franklin (1787) was also given up, and another structure erected in 1796 was known subsequently as the old garrison. The city was laid out in 1795 and incorporated in 1868. It has the commission form of government. Pop. (1910) 9,767; (1920) 9,970.

Franklin, town, Tennessee, county seat of Williamson county, on the Harpeth River, and on the Louisville and Nashville Railroad; 20 miles southwest of Nashville. It is the seat of the Tennessee Female College and the Battle Ground Academy. A Confederate cemetery and Fort Granger are points of interest. Franklin is situated in an agricultural district, and manufactures lumber, flour, carriages and mantles. It was settled in 1792 and was the scene of important action in the Civil War (see FRANKLIN, BATTLE OF). Pop. (1910) 2,924; (1920) 3,123.

Franklin, BATTLE OF, a stubbornly contested battle of the Civil War, fought on Nov. 30, 1864, at Franklin, Tenn., between General Schofield with a force of 29,000, and a Confederate force of 41,000 under General Hood. Schofield had been ordered to fall back slowly from his position at Pulaski, Tenn., to Nashville, and to delay Hood as much as possible, so as to give General Thomas at Nashville more time for concentrating there an adequate Federal force. Schofield, after a narrow escape at Spring Hill (q. v.), reached Franklin before daybreak on Nov. 30, but, owing to the absence of pontoon bridges, which he had asked to have sent there, he was delayed on the south side of the Harpeth river. Here he entrenched and awaited attack, though before the attack was delivered he was able to get his artillery across and place it so as to bear on the advancing Confederates. Before his line of entrenchments Schofield placed General Wagner with two brigades, ordering him to retire within the lines as Hood advanced. Wagner, however, in disregard of orders, attempted to make a stand, but his troops were quickly driven in great confusion, closely followed by the Confederates, back to the entrenchments, in which a dangerous gap was made. The gap was filled by General Opdyke, and from 4 P.M. until after dark the Federals beat back attack after attack. Hood finally drew off his troops, and during the night Schofield got all of his army across the river, joining Thomas at Nashville early on the following day. The Federal line of battle was under the actual command of Gen. J. D. Cox. The battle is considered to have been tactically drawn; the Federal loss was about 2,300, the Confederate, about 6,300.

A number of other actions took place at Franklin. On April 10, 1863, a Federal Force under General Granger repulsed an attack led by General Van Dorn.

Consult Johnson and Buel's *Battles and Leaders of the Civil War* (4 vols.); Cox's *Battle of Franklin, Tenn.*; Schofield's *Forty-six Years in the Army.*

Franklin, or **Frankland,** STATE OF, a name given to an extra-legal government established in 1784 by the settlers in what is now East Tennessee, then owned by North Carolina. The settlers, angered by North Carolina's cession of their district to the Confederation, organized a government and elected John Sevier governor; North Carolina then revoked her cession, suppressed the 'State' of Franklin in 1788, and in 1789 again ceded what is now Tennessee to the general government. See TENNESSEE.

Franklin, BENJAMIN (1706–90), American statesman and author, was born in Boston, Jan. 17, 1706. When ten years old, he was taken from school to assist his father, who was a tallow chandler and soap-boiler. Three years afterwards he was apprenticed to his older brother, James,

Franklin

who was a printer. The relations between the brothers were not pleasant, and in 1723 Benjamin ran away, going first to New York and thence to Philadelphia, where he shortly found work in the printing-office of Samuel Keimer. His abilities attracted the attention of the governor of Pennsylvania, Sir William Keith, who urged him to set up an office for himself. Relying upon the promise of the governor to aid him, and with his father's consent, Franklin went to London to buy type and supplies, only to find on arrival that the promised support was not forthcoming, and that he himself was penniless in a strange land. He worked at his trade in London until the summer of 1726, when he returned to Philadelphia. There he shortly established a printing-office of his own.

From this time until the beginning of the troubles with Great Britain, Franklin grew steadily in influence and importance. The excellence of his work, his industry, and his business shrewdness presently obtained for him a large share of the public printing of Pennsylvania, Delaware, and New Jersey. In 1728 he established the *Pennsylvania Gazette*, which became the leading newspaper between New York and Charleston, and of which he retained the ownership until 1748. A pamphlet entitled 'A Modest Inquiry into the Nature and Necessity of a Paper Currency,' published in 1729, though specious in argument, did much to induce the adoption of paper currency in the province, and secured for Franklin the printing of the money first issued. In 1732, he began the publication of *Poor Richard's Almanac*, which for twenty-five years held its place as the most notable compilation of the kind in the English language, and whose homely sayings and genial wit made the name of 'Poor Richard' a household word. The annual sales of the *Almanac* averaged 10,000 copies. With all his business, Franklin continued to be an indefatigable and omnivorous reader, and a zealous promoter of educational and social enterprises. He organized a club, known as the 'Junto,' for reading and debate, established a circulating library, studied French, Spanish, Italian, and Latin, and cultivated a simple, direct, homely literary style. He was one of the organizers, in 1730, of the first Masonic society in America, being himself elected grand master in 1734. In 1730 he married Deborah Read, of Philadelphia, who died in 1774.

His active political life began in 1736, when he was chosen clerk of the General Assembly of Pennsylvania, an office which he retained by successive elections until 1750, when he became a member of the Assembly. In 1737 he was made postmaster of Philadelphia. A night-watch, a fire company, the American Philosophical Society, and a school, which in 1779 became the University of Pennsylvania, were organized or inspired by his restless energy. The Franklin stove, or 'Pennsylvania fireplace,' was perfected in 1742. During King George's War (1741–1748), he was active in providing for the defence of the colony against the French and Indians, and at the close of the war served as commissioner to treat with the Indians. In 1751 he aided in the establishment of a hospital in Philadelphia, securing for its partial support an annual grant of £2,000 from the Assembly. The paving of the streets of the town was begun about the same time, at his suggestion. In 1753 he was made one of the two deputy postmasters-general for North America, an office which he filled until 1774. By this time his business had earned him a substantial competency, though he was never rich; while his scientific discoveries had given him an international reputation. His experiments with electricity, to which subject his attention first became directed about 1746, won him the rare honor of membership in the Royal Society, though not until after the society had first rejected with derision his alleged discoveries. He was undoubtedly the foremost man in the colonies—a fact attested by Harvard and Yale, both of which colleges conferred upon him the degree of Master of Arts.

At the colonial congress at Albany, in 1754, called by the Lords of Trade to plan measures of defence against the French and to conclude a treaty with the Six Nations, Franklin, who was a member from Pennsylvania, submitted a plan of colonial union. The plan was adopted by the congress, but rejected by the colonial assemblies and not considered by the crown. In a correspondence with Governor Shirley of Massachusetts, later in the year, Franklin pointed out clearly the fundamental grounds upon which resistance to Great Britain was shortly to be based, viz., the right of English subjects to a voice in the imposition of taxes, the lack of colonial representation in Parliament, and the considerable tribute already paid to the mother country by means of the trade laws. During the French and Indian War which followed (1754–1761)—the American phase of the Seven Years' War in Europe—Franklin took a prominent part in directing the defence of Pennsylvania, and it was mainly through his exertions, joined to the pledge of his personal credit, that supplies were obtained for Braddock's disastrous expedition.

It was at this time that the bitter struggle which for several years had been going on between the people of Pennsylvania and the Penn family, the proprietaries of the colony, over the taxation of the proprietary lands, became acute. In 1757 the Assembly of the province sent Franklin, who had been the most prominent opponent of the proprietary claims, to England to lay the case before Parliament. In 1759 he published in London *An Historical Review of the Constitution and Government of Pennsylvania*, an elaborate, but partisan, setting forth of the claims of the province. After more than three years of argument and delay, the controversy ended in a substantial victory for the province. Franklin did not return to Pennsylvania until late in 1762. His stay in England was, on the whole, extremely pleasant. He was received with honor by scientists and writers, while social attentions were showered upon him. He travelled extensively, met many distinguished people whose friendship he retained, received the freedom of Edinburgh, and was given the degree of Doctor of Laws by the universities of St. Andrews and Oxford. On his return to Philadelphia he was received with marked honor, in addition to an election, in advance of his arrival, to a seat in the Assembly. His natural son, William, was appointed governor of New Jersey.

A period of great public activity for Franklin now begins. In 1763 he inspected the postal service throughout the colonies, travelling 1,600 miles in the course of the year. A heated dispute between the governor and the Assembly led to the publication of *Cool Thoughts on the Present Situation of our Public Affairs*, in which the assumption of the province by the crown was suggested. A petition to the king, embodying this proposal, was also drafted by Franklin, voted by the Assembly, and signed by its author as speaker. The course of Franklin, however, joined to the hostility of the proprietary party, had by this time somewhat dimmed his popularity, and in the election of members of the Assembly (October, 1764) he was defeated; but he was shortly chosen agent to present to the crown the petition of the colony for a change of government. He reached London in December, to find Parliament, under the lead of Grenville and Charles Townshend, about to accept the Stamp Act. A resolution against the proposed act, whose purport had already been communicated to the colonies by Grenville, had been

Franklin

passed by the Pennsylvania Assembly before Franklin left; and he now (February 2, 1765), in company with other colonial agents, had an interview with Grenville and remonstrated against the act. The remonstrance was useless, and on March 22d the Stamp Act received the royal assent by commission. Franklin, though he had worked hard against the act, did not doubt that it would be enforced, and at the request of Grenville suggested his friend John Hughes as stamp distributor for Pennsylvania. The recommendation was one of the few political blunders of Franklin's long career, and was later the occasion of bitter denunciation on the part of his enemies. But the forceable nullification of the Stamp Act by the colonists soon undeceived both Franklin and the ministry. On the other hand, the extraordinary popularity of Franklin in England made him the most valuable defender whom the colonies could have had. In February, 1766, he was examined at the bar of the House of Commons in regard to the situation in America; and his bold and adroit answers, shortly published, made a deep impression.

In the almost unbroken discussion of American affairs during the next eight years he took a prominent part, contributing frequently to newspapers and periodicals, and corresponding actively with public men. In 1768 he was appointed colonial agent for Georgia, in 1769 for New Jersey, and in 1770 for Massachusetts. His course at this time was, indeed, too moderate for extremists in either country, and the appointment as agent for Massachusetts was carried through only in the face of strong opposition from Samuel Adams. Lord Hillsborough, who became secretary of state for the colonies in 1767, refused to recognize Franklin as the Massachusetts agent, on the ground of informality in the appointment, but his influence was not lessened so long as 'all England practically treated him as the representative of all America.' Hillsborough went out of office in July, 1772, and was succeeded by Lord Dartmouth, with whom Franklin was on good terms, and whom he had actually suggested for the place. The publication of the 'Hutchinson letters,' however, caused a great change. In 1772 several letters written by Governor Thomas Hutchinson, of Massachusetts, and others to William Whately, a member of Parliament and under-secretary of state, and containing expressions reflecting on the motives and course of the patriot leaders and urging the need of stronger royal control, fell into Franklin's hands. Franklin was quick to see the political advantage which the possession of the letters afforded, and in December sent them to Thomas Cushing, speaker of the Massachusetts House of Representatives, but without giving direct permission to publish them. The letters were, of course, promptly printed, and greatly intensified the popular bitterness against the crown officers in the colony. The Massachusetts general court petitioned for the recall of Hutchinson. When the letters appeared in England, a storm of denunciation burst upon Franklin. In a communication to the London *Public Advertiser*, Dec. 25, 1773, Franklin, while giving no hint of the way in which the letters were obtained, assumed entire responsibility for procuring and publishing them, and further justified his action by insisting that the letters, being obviously intended to influence the conduct of the government, were to all intents and purposes public. At an inquiry into the matter before the Lords of Trade, in January, 1774, Franklin was abusively denounced by Wedderburn, the solicitor-general, and was shortly removed from his office of deputy postmaster-general for North America. He continued to act as agent, and in December, 1774, with Arthur Lee and William Bollan, representing Massachusetts, presented to Lord Dartmouth the declaration of rights and the petition to the king adopted by the first Continental Congress. Chatham stood by him, and in February, 1775, defended him in the House of Lords from an attack by Lord Sandwich. His popularity had been shattered, however, and this, together with the decision of the ministry to compel the obedience of the colonies, terminated his usefulness for the time being. In March, 1775, he sailed for America, destroying with his departure the last hope of reconciliation between the colonies and the mother country.

Benjamin Franklin.
(From the Du Plessis portrait in the Museum of Fine Arts, Boston.)

Before he reached Philadelphia, the Revolutionary War had begun, and the day after his arrival he was chosen a delegate to the second Continental Congress. He drew up the first plan of union laid before Congress; organized the postal system, himself holding the office of postmaster-general; served on the committee to confer with Washington at Cambridge, on that to arrange for engraving and printing the Continental paper money, and on that to consider Lord North's conciliatory resolution; and made a toilsome journey to Montreal to discuss Canadian affairs with Benedict Arnold. He was at the same time chairman of the Pennsylvania Committee of Safety; served for a time as member of the Assembly; and in 1776 was president of the constitutional convention of the State. He was also a member of the committee which drafted the Declaration of Independence. When Lord Howe, in the summer of 1776, undertook to treat with Congress for reconciliation, Franklin served as one of the commissioners with whom Howe vainly discussed the matter. In September he was chosen envoy to France, to act in co-operation with Arthur Lee and Silas Deane.

On his arrival in France, Franklin was welcomed with enthusiasm. As a scientist of world-wide fame, and one of the eight foreign members of the Royal Academy of Sciences of France, his social position was assured; while his venerable appearance and democratic simplicity won the hearts of the populace. His great skill as a negotiator and immense personal popularity, re-enforced by the then hereditary antipathy of the French and English people for each other, conspired to favor the purpose of his mission. A treaty of alliance with the United States was signed by the French king on Feb. 6, 1778; while opportune and substantial aids in arms and munitions of war as well as money were supplied from the royal arsenals and treasury. From this time Franklin's hardest task was to find the money for which Congress was repeatedly calling. With John Adams and John Jay he concluded with Great Britain the provisional treaty of peace of Nov. 30, 1782, which was superseded by the definitive treaty, in the same terms, of Sept. 3, 1783. He continued to discharge the duties of minister plenipotentiary at Paris until 1785, when, in consequence of advanced age and increasing infirmities, he was relieved at his own request.

On his arrival at Philadelphia, in September, he was elected president of the Council of the State, an office which he held for three years. The presidency of the trustees of the University of Pennsylvania was also conferred upon him. He was not among the first representatives of Pennsylvania in the Federal Convention of 1787, which framed the Constitution, but was shortly chosen to a seat in order that, in case of the absence of Washington, 'there might be some one whom all could agree in calling to the chair.' He was not prominent in the debates of the Convention, and did not approve of all the provisions of the new Constitution; but he regarded the instrument as the best obtainable under the circumstances, and signed it. His last public act was the signing of an anti-slavery petition to Congress as president of the Pennsylvania Society for Promoting the Abolition of Slavery.

Franklin died in his eighty-fourth year, on April 17, 1790. A great multitude followed his body to its final resting place in Christ Church Cemetery, Philadelphia. Congress voted to 'wear the customary badge of mourning for one month'; and Mirabeau pronounced in the National Assembly of France an eloquent eulogy upon him.

Franklin's writings continue to this day to be republished in almost every written tongue. He wrote nothing for the press after the termination of his editorial career except a half-dozen or more comparatively brief contributions to the journals of the day. His complete writings, which have been edited by John Bigelow, Jared Sparks, and A. H. Smyth, consist almost exclusively of letters addressed to private individuals, very few of which were given to the press in his lifetime. Even his scientific discoveries were communicated to the world in letters to personal friends. The very interesting *Autobiography* was specially edited by Bigelow. Consult the *Lives* by Sparks, J. Parton, and J. T. Morse, Jr.; J. B. McMaster's *Benjamin Franklin as a Man of Letters;* P. L. Ford's *The Many-Sided Franklin;* S. G. Fisher's *The True Benjamin Franklin;* E. E. Hale and E. E. Hale Jr.'s *Franklin in France;* MacDonald's *Some Account of Franklin's Later Life* (1905); Eliot's *Four American Leaders* (1906); Pepper's *The Medical Side of Benjamin Franklin* (1911).

Franklin, EDWARD C. (1862–1937), American educator, was born in Geary City, Kans., and was educated at the University of Kansas, at Berlin, and Johns Hopkins (PH.D. 1894). He has been assistant and associate professor of chemistry and professor of physical chemistry at the University of Kansas (1893–1903), professor of organic chemistry at Leland Stanford (1903–11), and chief of the division of chemistry, U. S. Public Health Service (1911–13). He has made investigations into the properties of liquid ammonia and other non-aqueous solvents.

Franklin, SIR JOHN (1786–1847), English Arctic explorer, was born in Spilsby, Lincolnshire. In 1800 he was appointed to the quarterdeck of the *Polyphemus,* and took part in the Battle of Copenhagen. Two months after this engagement he joined the *Investigator,* commanded by his relative Captain Flinders, who was commissioned to explore and map the coasts of Australia. Wrecked in the *Porpoise* (1803) off the coast of Australia, he made his passage from Canton to England in the *Earl Camden,* commanded by Sir Nathaniel Dance, and acted as signal midshipman in the action, on Feb. 15, 1804, in which Captain Dance repulsed a strong French squadron. He occupied a similar post on the *Bellerophon* in the Battle of Trafalgar, and in 1814 distinguished himself in the attack on New Orleans, receiving a slight wound in the hand-to-hand combat. In 1818 he was appointed to the *Trent,* as second to Captain Buchan of the *Dorothea,* in the expedition sent by way of Spitzbergen. In the following year he led an expedition proceeding from York Factory through Rupert's Land, which descended the Coppermine River, and traversed 5,550 miles by land and water. In a second expedition (1825–7) he descended the Mackenzie River, and traced the coast thence through 37° to near the 150th meridian. In recognition of his achievements he was knighted (1829).

In 1845 Franklin was appointed to the command of an expedition for the discovery of the Northwest Passage. The expedition, consisting of the *Erebus* and *Terror,* with 134 chosen officers and men, sailed from Greenhithe on May 19, 1845, and was last seen on July 26 following by a whaler in Baffin Bay. No tidings of the expedition having reached

England, as many as fifteen expeditions were despatched between 1848 and 1854 by England and America, with the object of rescuing or at least finding traces of the missing explorers. In July, 1857, an exploring party under Captain M'Clintock in the yacht *Fox*, purchased and fitted out by Lady Franklin, gathered articles belonging to Franklin's ships, while skeletons found along the western and southern coasts told the tale of disaster. A record found in a cairn at Point Victory revealed the history of the expedition down to April 25, 1848. An addendum in the handwriting of Captain Fitziames narrated that the *Erebus* and *Terror* were deserted April 22, and that Franklin died June 11, 1847. In 1878–80 the expedition of Lieutenant Schwatka of the U. S. army found the skeletons and other relics of Franklin's men.

Franklin, WILLIAM (1729–1813), Colonial governor of New Jersey, the natural son of Benjamin Franklin, was born in Philadelphia. At the age of fifteen he served for four years on the Canadian frontier in King George's War. He was then made captain, and won distinction for gallant conduct at Ticonderoga. Subsequently he studied law in London, England, was called to the bar, and was made by Lord Fairfax governor of New Jersey (1762). During the Revolution some of his captured correspondence revealed such strong loyalist sentiments that he was declared an enemy and put under guard, and then on parole. He was subsequently rearrested and held a prisoner at East Windsor, Conn., for attempting to reconvene the legislative assembly of New Jersey that had been dissolved. In 1778 he was exchanged, and after living in New York for four years went to England, where he resided until his death, supported by a royal pension. In 1784 the long estrangement between father and son was patched up, though Franklin disinherited him.

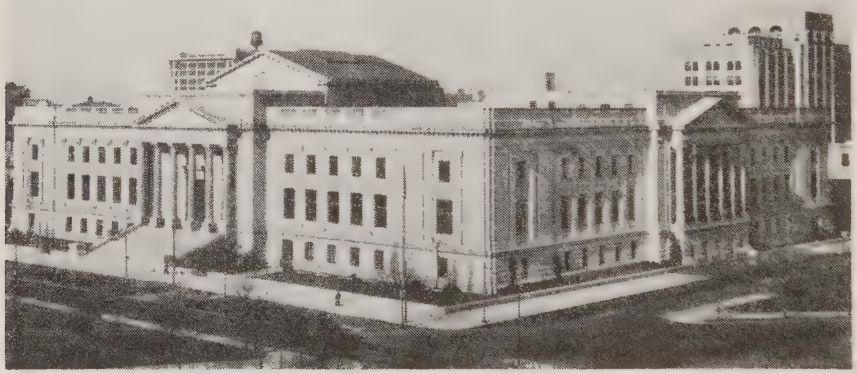
Franklin, WILLIAM BUEL (1823–1903), American soldier, was born in York, Pa., and was graduated from West Point (1843). He served through the Mexican War in an engineering capacity and on the staff of General Taylor, being brevetted for gallantry at the battle of Buena Vista. Until the Civil War he was engaged in making Western surveys, in lighthouse contruction, and as instructor of physics at West Point. He fought at the Battle of Bull Run (July, 1861) as brigadier-general of volunteers, and in nearly all the battles of the Peninsular Campaign. In July, 1862, he was made a major-general and commander of the Sixth Corps, Army of the Potomac; and in December, 1862, commanded the left grand division at the Battle of Fredericksburg. He was accused by General Burnside (q. v.) of not obeying his orders, was censured by the Committee on the Conduct of the War, and was removed for insubordination. In July, 1863, he was assigned to a command in the Department of the Gulf, and was wounded at the Battle of Sabine Cross Roads (April, 1864). He resigned from the service in 1866, and became vice-president of the Colts Firearms Company.

Franklin and Marshall College, an institution of learning at Lancaster, Pa., founded in 1853 by the consolidation of Franklin College, at Lancaster (founded 1787), and Marshall College, at Mercersburg (founded 1836).

For recent statistics see the table under COLLEGE.

Franklin College, a co-educational institution founded by the Baptist denomination at Franklin, Ind., in 1834. It has Collegiate and Music Departments, and confers the bachelor's degree. Courses in letters, science, and the humanities are offered. The school is on the Carnegie Foundation. For recent statistics concerning enrollment, etc., see table under COLLEGE.

Franklin Institute, THE, of the State of Pennsylvania for the promotion of the mechanic arts, was founded Feb. 5, 1824, in Philadelphia. It combines within itself the features of a scientific museum, a mechanics' institute, and a scientific society. Since 1832 it has given popular scientific lectures for laymen, and highly technical readings for special scientific bodies. The Institute is organized into five sections: physics and chemistry photography and microscopy; electricity; mining and metallurgy; and mechanics and engineering. The official publication of the Institute is a monthly journal which has had a continuous existence since 1826. It has one of the finest technical libraries of its kind in the country, containing more than 87,000 volumes and 27,000 pamphlets, as well as one of the most complete records of American inventions. Awards by the Institute, prized and recognized throughout the world, are the Franklin Medal, the highest award, made for an outstanding career in the physical sciences; and the Elliott Cresson Medal for scientific discovery and original research. Among winners of the former have been Rutherford



Courtesy the Franklin Institute. Photo by Gladys Müller

THE FRANKLIN INSTITUTE, PHILADELPHIA

Orville Wright, Einstein, and Millikan.

Frank-marriage. Under the common law of England, a special fee tail estate created by the conveyance of lands to the bridegroom of a female relative of the donor with a limitation to the issue of the marriage. The donees held of the donor under this form of tenure, and a valid remainder could not be created to take effect within four generations from the original donee. This kind of tenure came within the prohibitions of the statute *Quia Emptores,* and as only the crown was exempt, it became practically obsolete. It does not exist in the United States.

Frank-pledge. After the first series of Danish invasions (855–89) measures were taken by the English for preserving order. Every man was compelled to have some one to answer for him. In many parts of England a number of men would form an association, the members of which were bound to do their utmost to bring to justice any one of their body who broke the peace. The Normans adopted this system, called it frank-pledge, and made it more severe.

Franks, THE, a confederation of tribes who are found about 250 A.D. settled in the lower Rhine valley, and grouped shortly afterwards as Salian Franks (on the lower Rhine) and Ripuarian Franks (on the middle Rhine). After the accession of Clovis, in 481, to the throne of the Salian Franks, the dependence upon Rome, which had lasted since the early part of the 5th century, came to an end. Clovis, having occupied the Seine valley, overthrew (496) the Alemanni, and then became an orthodox Christian. This induced the church to throw all its influence on the side of the Salian Franks, who by 510 had conquered or absorbed all the other Frankish tribes. At that time the kingdom of Clovis included most of modern France north of the Loire. The next epoch in the history of the Franks was marked by their division (567) into the Austrasian and Neustrian Franks, their struggle for supremacy, and their final separation. The careers of Fredegond and Brunhilda illustrate the hostility between the Austrasian and Neustrian Franks, and the death of Brunhilda in 613 marks the temporary victory of the Austrasians. The Austrasian mayors of the palace arose, and the battle of Testry in 687 established the victory of the eastern over the western division, and was the deathblow of the Merovingian dynasty. The rise of the Carlovingians led to the formation of the empire of Charles the Great; but on his death quarrels ensued among his descendants, and finally, by the treaty of Verdun (843), the empire was dismembered. Three monarchies then arose, one of which was that of Germany, another that of France, and the third that of Burgundy and Lorraine. See L. Sergeant, *The Franks* (1898); also FRANCE.

Franks, SIR AUGUSTUS WOLLASTON (1826–97), English antiquary, born at Geneva, Switzerland; became assistant in the antiquities department of the British Museum (1851); he retired in 1896. A specialist in mediæval art, especially pottery, he also made important collections of Eastern work of various kinds, and was an authority on classical art. His most important publication is his *Catalogue of Oriental Porcelain and Pottery* (1876 and 1878).

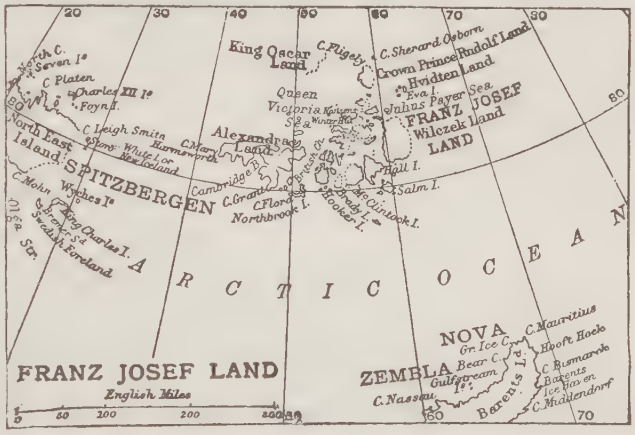
Franz, ROBERT (1815–92), German song-composer, born at Halle where he was appointed city organist (1841), master of music to the university, and director of the symphony concerts (1859). His first book of songs (1843) reached a high level of excellence, worthily maintained by his later songs, which raised the total number to about 250. Franz also edited Bach's *Matthäus Passion* and *Magnificat,* Handel's *Messiah,* Astorga's *Stabat Mater,* and other works. Deafness compelled his retirement in 1868, and later, a series of benefits arranged for him by his friends in Germany and the U. S., proved of great financial assistance.

Franzen, FRANS MICHAEL (1772–1847), Swedish author, born in Finland, was elected librarian at the University of Abo (1795), in 1798 professor of literaure, and in 1801 professor of history there. On the cession of Finland to Russia he migrated to Sweden, and became bishop of Hernösand (1831). From 1808 he was a member of the Swedish Academy. His fresh, natural verse, with its naive idyllic charm, expressed in the most exquisite language, shows great originality. An edition of his collected poems, in 10 vols., was issued in Stockholm between 1867 and 1889, among them being his epic poem *Columbus.*

Franzensbad, wat.-pl., Czechoslovakia, stands among the spurs of the Erzgebirge and the Fichtelgebirge, 4 m. by rail N. of Eger. It was part of the Sudeten territory which was given to Germany at the Munich Conference, 1938. Pop. 1,850.

Franz Josef. See FRANCIS JOSEPH.

Franz Josef Land, renamed FRIDTJOF NANSEN LAND, archipelago of some 100 islands, 42° to 64° E. and 80° to 82° N., about 250 m. to the E. of Spitzbergen. Nearly the whole group is covered with snow-clad glaciers. Franz Josef Land was



discovered in 1873 by Payer and Weyprecht. Later explorers have shown that much of what was then believed to be continuous land is broken up into islands. In the summer of 1880 Mr. Leigh Smith surveyed much of the S. coast. In 1894 the Jackson-Harmsworth expedition formed a settlement at Cape Flora, where they remained for three and a half years (1894–7), occupied with scientific observations. Here in 1896 (June 17) occurred the dramatic meeting with Nansen and Johansen, who had spent the previous year in the northern part of the archipelago. Wellman was in Franz Josef Land in 1899; the Duke of the Abruzzi and Prince Amadeus of Savoy explored in this region

in 1899–1900; and the Ziegler expedition (1903–5) went north by the Franz Josef route. See F. G. Jackson, *A Thousand Days in the Arctic* (1899); J. Payer, *New Lands within the Arctic Circle* (1876). Leigh Smith's two voyages are described by Sir C. Markham (*Proc. Roy. Geog. Soc.*, iii), and Nansen's observations are recorded in his *Farthest North* (1897).

Franzos, Karl Emil (1848–1904), German novelist, born in Russia, son of a Jewish doctor. From 1877–82 and from 1884–87 he lived in Vienna, in 1884 and after 1887 in Berlin, where he edited the review *Deutsche Dichtung*. He wrote numerous novels, in many of which he depicts with great power and brilliant coloring the varied types of men in his old home and the strange charm of its scenery, particularly in *Aus Halb-Asien* (1876–90) and in his remarkable novel, *Ein Kampf ums Recht* (1882). Other novels are *Die Juden von Barnow* (1877); *Stille Geschichten* (1880); *Moschko von Parma* (1880); *Mein Franz* (1883); *Der Präsident* (1883); *Judith Trachtenberg* (1890); *Der Wahrheitssucher* (1894); and *Allertei Geister* (1897).

Frapan-Akunian, Ilse, pseudonym of Ilse Levien (1852–1908), German novelist. She achieved great popularity by her admirable short stories and sketches, which include *Hamburger Novellen* (four series, 1886, 1888, 1890, 1895); *Bittersüss* (1891); *Bekannte Gesichter* (1893); *Flügel auf!* (1895); *In der Stille* (1897); *Was der Alltag dichtet* (1899); *Wehrlose* (1900); *Arbeit* (1903); *Erich Hetebrink* (1907).

Lower Fraser Cañon and Franklin Rock, near Yale, B. C., Canada, on line of Canadian Pacific R. R.

Frascati, tn., episc. see, and summer resort of Italy, prov. Rome, stands on the Alban Hills, 980 ft. above the sea, and 15 m. by rail S.E. of Rome. It represents the ancient Tusculum, and possesses several handsome villas—*e.g.* Torlonia (Conti), Aldobrandini, and Ruffinella. It is famous for its gardens and its wine. Pop. (1931) 11,414.

Fraser, riv., British Columbia, formed by the union of the S. Fork and the N. Fork. The S. Fork rises to the N. of Mt. Brown in the Rocky Mts., and flows N.W. for 190 m., when it is joined at Fort George by the N. Fork, which also rises in the Rocky Mts. Thence the river flows S.; but on reaching the town of Hope it takes a bend to the W., and falls, after a course of 750 m., into the Strait of Georgia, which separates Vancouver I. from the mainland. The river is navigable for steamboats as far as Yale (190 m.). Large ships can reach New Westminster. Between Lytton and Yale the river flows through Big Cañon, where the scenery is magnificent. The salmon canneries of the river are exceedingly important. The river is so called from Simon Fraser (1776–1862), a fur trader, who explored it in 1808. Area of basin, 138,000 sq. m.

Fraser, Alexander Campbell (1819–1914), Scottish philosopher, appointed lecturer on mental philosophy at the New College, Edinburgh (1846). In 1856 he succeeded Sir W. Hamilton in the chair of logic and metaphysics in Edinburgh University; retired in 1891. He edited *The North British Review* from 1850 to 1857, and delivered the Gifford lectures (1894–6). His editions of Locke and Berkeley are standard works; and he also published *Essays in Philosophy* (1846–56);

Rational Philosophy (1858); *Philosophy of Theism* (1896); *Reid* ('Famous Scots Series,' 1898); *Biographia Philosophica* (1904); *Berkeley and Spiritual Realism* (1909).

Fraser, CHARLES (1782–1860), American artist, was born in Charleston, S. C. He practised law until 1818, when, having gained a competence, he retired and devoted himself to art. During the next forty years he painted the portraits of most of the prominent persons of the United States. In 1857 an exhibition of his works was given at Charleston, containing 313 miniatures, 139 landscapes, and a number of other pieces. His *Reminiscences of Charleston* appeared in 1854.

Fraser, SIR JOHN FOSTER, (1868–1936), British writer, born in Edinburgh. He became a journalist, and wrote descriptive sketches of proceedings in the British House of Commons. Subsequently he made a bicycle trip around the world, covering 19,237 miles in 774 days, of which he has written an account in his *Round the World on a Wheel*. In 1918 he toured the United States, helping to raise money for the Liberty Loan. His career is amply illustrated by his books, which include *The Real Siberia; America at Work; Canada as It Is; Pictures from the Balkans; Red Russia; Australia, the Making of a Nation* (1910); *The Land of Veiled Women* (1911); *Panama, and What It Means* (1913); *Russia of Today* (1916); *The Red Passport* (1918).

Fraser, SIMON, LORD LOVAT. See LOVAT.

Fraser, JAMES EARLE (1876–), American sculptor. As a boy, living in the Dakotas, he received the inspiration for his future Indian subjects, including the 'End of the Trail,' 'Prayer,' and the design for the 'buffalo' five-cent coin. At 18 he entered the Art Institute, Chicago, and went on to the École des Beaux Arts, Paris. In 1898 he won a prize for the best work by an American. Until 1902, when he returned to America, he was an assistant of Saint Gaudens. In 1906 he became an instructor in the Art Students' League, New York. Among his many well-known works are the bust of Theodore Roosevelt in the Senate, of Alexander Hamilton in the Treasury, the statue 'Journey Through Life' in the Rock Creek cemetery, 'Victory' in the Bank of Montreal, and the monument to Bishop Potter in the cathedral of St. John the Divine. He won many honors.

Fraserburg, district and town, Cape of Good Hope; 270 miles northeast of Cape Town. The district consists of typical karroo country. Pop. of district (1931) about 5,000; of town, 1,200.

Fraserburgh, seaport, Aberdeenshire, Scotland, on the southern slope of Kinnaird's Head; 47 miles northeast of Aberdeen. It is the chief centre of the Scottish herring fishery. The town was formerly called Faithlie or Philorth. Pop. (1931) 10,203.

Fraserville, or RIVIÈRE DU LOUP EN BAS, watering place, Quebec, Canada, on the Rivière du Loup, close to its confluence with the St. Lawrence, opposite Hare Island, and on the Intercolonial Railway; 120 miles northeast of Quebec. Its manufactures include shingles, pulp, leather, furniture, builders' materials, and machinery. Pop. (1921) 7, 703; (1931) 8,499.

Fratercula. See PUFFIN.

Fraternal Insurance, an agreement whereby a fraternal beneficiary society pays to its members or to their beneficiaries, as prescribed in its constitution and laws, death or other benefits in return for stated annual or monthly premiums. Fraternal insurance differs from old-line insurance (see INSURANCE) chiefly in being an obligation to pay under stipulated conditions, rather than a contract for indemnity against loss. Owing to the mutual character of fraternal organizations and their lack of soliciting agents, their rates are comparatively low.

Originally, the financial methods of fraternal societies in the United States and Canada closely resembled those of the English friendly societies. Uniform assessments were made according to need, and the amount and occasion of benefit were not explicitly defined. The failure of many early societies demonstrated the need of more adequate provision for the inevitable rise in death rate due to the increased age of members. The level premium system was thereupon introduced, grading the premiums of each member according to his age at entrance. This plan, though an improvement, was in turn found defective. In recent years the natural premium system, based upon attained age, and making the payment of each cover the year's risk, has been adopted by many societies. Variations of this are the step-rate plan peculiar to fraternal insurance, whereby the rates are increased at five-year intervals; and several modifications involving higher rates in youth to counteract insufficient later rates. The reserve is limited to one year, and is supplied by making premiums payable in advance.

The most influential agent in procuring these reforms has been the National Fraternal Congress, organized in 1886 primarily for the purpose of establishing uniform minimum rates throughout the United States. These were urgently needed, for the temptation to gain membership by low assessments had led many societies to organize on a basis which invited ultimate failure. Voluntary agreement on the part of the various orders proving impossible, and existing legislation being inadequate, a bill was draughted in 1910 for in-

National Fraternal Congress Table of Mortality

Age.	Mortality Probability.	Yearly Cost ($1,000 at 4%).	Annual Level Rates. ($1,000 at 4%).
21	.0050352	$4.841	$10.62
22	.0050708	4.876	10.92
23	.0051068	4.911	11.24
24	.0051535	4.956	11.57
25	.0052006	5.001	11.92
26	.0052587	5.057	12.28
27	.0053176	5.113	12.67
28	.0053877	5.181	13.08
29	.0054693	5.259	13.51
30	.0055520	5.338	13.96
31	.0056466	5.430	14.43
32	.0057532	5.532	14.94
33	.0058723	5.646	15.47
34	.0060040	5.773	16.03
35	.0061487	5.912	16.62
36	.0063067	6.064	17.24
37	.0064895	6.249	17.90
38	.0066977	6.410	18.60
39	.0069209	6.655	19.34
40	.0071708	6.895	20.11
41	.0074483	7.162	20.93
42	.0077657	7.467	21.80
43	.0081129	7.801	22.72
44	.0084797	8.154	23.69
45	.0088668	8.526	24.72
46	.0092870	8.930	25.81
47	.0097538	9.379	26.91
48	.0102693	9.874	28.20
49	.0108238	10.408	29.51
50	.0114440	11.004	30.98
51	.0121337	11.679	32.39
52	.0128970	12.897	33.97
53	.0137511	13.222	35.65
54	.0146767	14.112	37.45
55	.0157054	15.101	39.36
56	.0168587	16.211	41.41
57	.0181200	17.423	43.60
58	.0194994	18.749	45.94
59	.0210513	20.241	48.45
60	.0227504	21.875	51.13
61	.0246434	23.695	....
62	.0267240	25.696	....
63	.0290330	27.916	....
64	.0315711	30.357	....
65	.0343904	33.067	....
66	.0375206	36.077	....

troduction into the State legislatures. This bill provided in part for sufficient rates based on sound mortality tables, and stipulated that societies found insolvent by their annual reports should be readjusted according to certain regulations. Laws have been passed in a majority of States containing the chief articles of the bill, and embodying the provision that future rates shall be calculated from mortality tables at least equal to those of the National Fraternal Congress. In 1933 the total income of the 80 societies represented in the National Fraternal Congress was $135,621,584; disbursements, $114,300,795; insurance in force (Dec. 31), $3,965,887,037.

In the accompanying Table of Mortality of the National Fraternal Congress, the yearly cost

Specimen Rates of Fraternal Societies for Whole Life Protection of $1,000.

Society.	Monthly Rate, Age 25.	Monthly Rate, Age 45.
American Woodmen	$1.85	$3.60
Ben Hur Life Association	1.39	2.92
Catholic Order of Foresters	1.27	2.49
Fidelity Life Association	1.41	2.77
Foresters, Independent Order of	1.72	3.76
Maccabees	1.55	3.00
Protected Home Circle	1.60	3.00
Royal Arcanum	1.44	2.80
Royal Neighbors of America	1.05	2.20
Security Benefit Association	1.25	2.70
Woman's Benefit Association	1.35	2.50
Woodmen Circle, Supreme Forest	1.44	2.72
Woodmen of America, Modern	1.05	2.30
Woodmen of the World	1.50	2.90

column indicates the actual risk expense on $1,000. To this should be added expenses of management, and for any emergency reserve or disability benefit. The higher annual level rates are due to the fact that as the age advances the cost of covering the mortality probability becomes prohibitive. Surplus payments are therefore made in youth, the interest value of the resulting reserve being deducted from later payments; new members are not admitted beyond the age of sixty years. See Insurance.

Consult W. Basye, *History and Operation of Fraternal Insurance* (1919); Nat. Ind. Conf. Bd., *Present Status of Mutual Benefit Associations* (1931); National Fraternal Congress of America, *Proceedings; The Fraternal Compend Digest*, annual.

Fraternal Societies, in the United States, are corporations or voluntary associations organized on the lodge system, with ritualistic ceremonies, for the advantage of members and their beneficiaries. Their usual foundation is a contract to pay, by means of assessments, a stipulated amount of insurance to the beneficiaries of deceased members, and in many instances sick, disability, or other benefits. They are not conducted for profit, and have no capital stock. The general aim of these societies is to cultivate a spirit of fraternity, and by encouraging social, intellectual, and other pursuits to convert their local branches into popular clubs. The government is carried on by representatives from the local branches, and the constitution and by-laws of each society are determined by the members. To some, men alone are eligible; some have attached organizations to which only women relatives are eligible; others admit both men and women; and a few are for women only.

The fraternal beneficiary societies of the United States are the outgrowth of the friendly societies of England, and have the same basis and fundamental principles, although they possess features which are distinctly American. The earlier English friendly societies, beginning about the middle of the seventeenth century, were non-secret, cooperative organizations formed to relieve members with financial assistance when in sickness or distress, and in some instances paying funeral benefits. After the reorganization of Freemasonry in England in 1717, a number of other charitable secret societies were organized, either in imitation or rivalry, but most of them differing in that they were in reality modern friendly societies constructed on the secret society lodge system. The more notable are the British Odd Fellows, founded 1745; the Foresters, 1745; the Ancient Order of the Golden Fleece, 1780; the Ancient Order of Druids, 1781; the Society of Ancient Shepherds, 1826; and the Ancient Order of Romans, 1833.

As early as 1730 the Masonic Order was introduced into Pennsylvania, and in 1735 there were lodges in half a dozen of the leading cities of America. In 1819 the Order of Odd Fellows found its way to the United States; in 1836, the Ancient Order of Foresters and the Ancient Order of Hibernians; in 1839, the Ancient Order of Druids. Following these came the Sons of Hermann in 1840, and the German Order of Harugari in 1847, which also adopted friendly society features. The Actors' Order of Friendship, organized in 1849, was the first distinctly American fraternal society, although the Improved Order of Red Men, formed in 1834, afterward developed beneficiary features.

The success of these societies has depended, in the main, on the ability of their assessment systems to meet the demands of their plans for insurance. The crude system at the start was that of a fixed, uniform rate monthly for each member, regardless of age. This was succeeded by the assessment system, in most cases based on the age of members at the time of admission, instead of on authoritative mortality tables. At the beginning, no attention was paid to the need of creating a reserve fund to meet the increasing demands of an aging membership. Accordingly, as the death losses rose with the age of the society, an increasing number of assessments were levied on the remaining members. The burden thus imposed constituted a strong temptation to leave the older societies and join newer ones organized on the same basis, but with smaller death losses. In recent years, however, the larger and better known societies have had the wisdom to increase their rates of assessment, graded according to age, and to provide for a reserve against the evil hour of epidemic, disaster, and the draught of a heavily increased membership of advanced age.

In 1886 the National Fraternal Congress was organized by a number of the older and larger fraternal societies, with the aim of securing uniform laws in the United States and Canada. Accordingly, in 1900–01 a bill was suggested by the Congress to the legislatures of several States, requiring death benefits from all societies, but with illness and old age benefits voluntary, and providing for larger and uniform rate charges. The bill was everywhere defeated by the opposition of outside societies and a minority of its own membership. In 1901 a second joint association of fraternal societies, the Associated Fraternities of America, was organized for the

purpose of opposing further legislation until public opinion should be so modified as to permit the fullest possible freedom to the societies in their adoption of adequate rates. In 1913 the two associations were united, and they have since co-operated in measures providing for the valuation of beneficiary societies and the increase of assessments sufficient to make them legally solvent.

Organization.—The organization of fraternal societies, based on the principle of representative government, includes a supreme body elected by the local lodges or chapters, and local bodies enjoying immediate jurisdiction in their districts. Each society has its own constitution, by-laws, rules, and regulations, and it exercises without right of appeal both discretionary and punitive administration to its members. The executive head and other high officers are members of the supreme council. The supreme body pays permanent disability and death benefits, makes laws for the society as a whole, and in most cases elects officers. In some of the newer organizations the grand jurisdiction is omitted or replaced by election districts. The ritual, mottoes, symbols, and pass words of each society are withheld from non-members, constituting its secret element.

In addition to the benefits provided in time of disability or death, the fraternal orders grant their members a social comradeship resulting from mutual sympathy and effort. This fraternal spirit is their distinctive characteristic, fostered by the lodge system of government and by the secret ritual. In its turn it prompts a voluntary service which secures better financial returns than would a bond of self-interest alone.

The accompanying table lists the leading societies.

See SECRET SOCIETIES; also separate articles on the individual fraternal societies. Consult Fraternal Monitor, *Statistics Fraternal Societies;* T. Graebner, *The Secret Empire* (1927); C. H. L. Brown and J. A. G. Taylor, *Friendly Societies* (1933).

Fraternities, College, or GREEK-LETTER SOCIETIES, are social and literary organizations of students at American universities and colleges. The titles of nearly all these societies are Greek letters, which usually refer to mottoes or watchwords; and these, with the accompanying grips and words, constitute the leading secrets imparted to novitiates.

College fraternities may be classified as General, Professional, Local, and Women's. Under the first group, the National Interfraternity Conference had 71 member societies in 1931, with chapters at from 5 to 108 higher institutions of learning, the membership of which is drawn from classical, literary, and scientific students. In 1929, membership in the first group was 800,094. There are a smaller number of prominent professional Greek-letter societies; and these, like the general fraternities after which they are patterned, have chapters at leading university law and medical schools; but unlike their prototypes, they admit members of other fraternities. Local college fraternities are similar to the foregoing, except that some have other than Greek-letter titles, and none are found at colleges other than where originally established. Corresponding to the general college fraternities are the sororities, or fraternities for women, numbering 35, some of them Greek-letter and some not, and a few of them widely extended on the chapter system. Membership in 1929 was 239,909.

Origin and Development.—The first society of American origin with a Greek-letter name was Phi Beta Kappa, which was founded on Dec. 5, 1776, at the College of William and Mary, in Virginia. Phi Beta Kappa was a secret society, and its objects were social enjoyment and the cultivation of literature. A chapter was established at Yale in 1780, and another at Harvard in 1781. When the approach of a British fleet caused the suspension of William and Mary in 1781, Phi Beta Kappa had enrolled fifty members, the most noted being John Marshall, who became Chief Justice of the United States, and Bushrod Washington, a nephew of George Washington. In 1787 Harvard and Yale chapters joined in establishing a chapter at Dartmouth. The next chapters chartered were those at Union in 1817; Bowdoin, 1825; Brown, 1830; Trinity, 1845; and Wesleyan, 1845. The society was restored at William and Mary in 1849.

Owing to the prejudice against secret societies aroused by the anti-Masonic excitement which prevailed throughout the United States for a number of years, the secrets of Phi Beta Kappa were exposed to the public in 1831. It then transpired that the Greek letters were the initials of '*Φιλοσοφία Βίου Κυβερνήτης*,' translated 'Philosophy is the guide of life.' The original badge consisted of a square silver medal, suspended by a cord from a ring on one side. On the obverse were the Greek letters ΦΒΚ, across the middle, and in the lower right corner a hand pointing to three stars in the upper left corner. On the reverse were the letters S and P in a monogram above, and the date Dec. 5, 1776, below. The Roman letters on the badge were the initials of *Societas Philosophiæ*. After 1831 Phi Beta Kappa became merely an honorary college society, in which membership was conferred as a reward for scholarship.

Women were first admitted to Phi Beta Kappa in 1875. In 1883 a national organization of the chapters was effected by the adoption of a constitution for 'The United Chapters of the Phi Beta Kappa Society.' In 1898 a charter was granted for a chapter at Vassar, and since then chapters have been established at several other colleges for women. There are 114 chapters and about 70,000 living members. The *Phi Beta Kappa Key* was published from 1910–31, and was succeeded by the *American Scholar*.

The establishment of Phi Beta Kappa at Union in 1817 led to the organization there of Kappa Alpha in 1825, and within two years two other Greek-letter societies were established there, Sigma Phi and Delta Phi. Of the older organizations, Alpha Delta Phi, Psi Upsilon, and Delta Kappa Epsilon are the historic three which have faced each other at leading older colleges, and they rank as leaders to-day. Kappa Alpha, Sigma Phi, Delta Phi, and Delta Psi have ever clung to few chapters, small membership, and social exclusiveness. Those with the most members are Alpha Tau Omega, Delta Tau Delta, Kappa Sigma, Phi Delta Theta, Phi Gamma Delta, Sigma Alpha Epsilon, Sigma Chi, Sigma Nu, and Theta Nu Epsilon.

For sixty years after Kappa Alpha was founded, in 1825, fraternities met with much opposition from college faculties, who charged them with clannishness and with interfering with college discipline. At many institutions fraternities were prohibited, and the chapters were forced to disband or to continue *sub rosa*. However, as the fraternities grew older they became stronger, and many of their graduate members became college professors and trustees, with the result that faculty opposition gradually ceased. At present, fraternities thrive at all prominent institutions in the United States except Oberlin and a few others, where they are still prohibited. The

Fraternities, College

first college fraternity in Canada was Zeta Psi, which entered Toronto in 1879 and McGill in 1883. No college fraternities are found outside the United States and Canada. In the United States they have recently been widely imitated among students of preparatory schools and academies.

Organization.—The founders of Phi Beta Kappa wrought out the essential features of the modern Greek-letter fraternity, and so incorporated them in laws and traditions as to influence strongly college fraternity customs in subsequent years. These features included a secret social organization, with a name of Greek letters; the letters were the initials of a secret motto, which briefly expressed the aims of the society. The members magnified the word 'fraternity' and the bond of brotherhood. Phi Beta Kappa had a constitution, a form of initiation with its 'oath of fidelity,' secret signs of salutation and recognition, a secret grip, a cipher, a badge, a seal, and society colors. The founders held regular meetings for social, literary, and business purposes. At the meetings there were literary exercises, and in this Phi Beta Kappa set an example which was followed for years by modern fraternities,

Principal Fraternal Societies of the United States and Canada

Society.	Year Founded.	Membership.	Home Office.
Aid Association for Lutherans	1902	111,787	Appleton, Wis.
American Woodmen	1901	35,280	Denver, Col.
Ben Hur Life Association	1894	61,906	Crawfordsville, Ind.
Brith Abraham, Independent Order of	1887	75,389	New York.
Brotherhood of Locomotive Firemen and Engineers	1873	55,516	Cleveland.
Brotherhood of Railroad Trainmen	1883	105,383	Cleveland
Catholic Order of Foresters	1883	127,889	Chicago.
Croatian Fraternal Union of America	1925	76,912	Pittsburgh.
Daughters of America	1907	118,661	Cincinnati.
Degree of Honor Protective Association	1896	88,777	St. Paul, Minn.
Eagles, Fraternal Order of	1898	575,000	Kansas City, Mo.
Eastern Star, Order of the, Grand Chapter	1896	11,656	Washington, D. C.
Elks, Benevolent and Protective Order of	1868	560,000	Chicago.
Fidelity Life Association	1896	56,782	Fulton, Ill.
First Catholic Slovak Ladies' Union	1892	60,901	Cleveland.
First Catholic Slovak Union	1892	94,944	Cleveland.
Foresters of America	1790	185,000	Jersey City, N. J.
Foresters, Independent Order of	1874	145,000	Toronto.
Freemasons, Grand Lodge, Free and Accepted, of the State of New York	1781	314,229	New York.
Freemasons of the United States of America, Gen. Grand Chapter of Royal Arch	1798	665,723	Coldwater, Mich.
Freemasons, Supreme Council, 33° Ancient Accepted Scottish Rite	1813	279,312	Boston.
Gleaner Life Insurance Society	1894	49,079	Detroit.
Greek Catholic Union of Russian Brotherhood of the United States of America	1892	86,261	Homestead, Pa.
Hibernians, Ancient Order of	1836	100,000	Chicago.
Knights of Columbus	1882	454,763	New Haven.
Knights of the Golden Eagle	1873	60,000	Philadelphia.
Knights of Pythias (Supreme Lodge)	1864	368,674	Minneapolis.
Ladies' Catholic Benevolent Association	1890	100,444	Erie, Pa.
Maccabees	1878	159,948	Detroit.
Moose, Loyal Order of	1888	488,903	Mooseheart, Ill.
Neighbors of Woodcraft	1897	79,081	Portland, Ore.
Odd Fellows, Sovereign Grand Lodge of the Independent Order of	1819	1,921,534	Baltimore.
Owls, Order of	1904	395,000	Hartford, Conn.
Polish National Alliance of the U. S.	1880	256,913	Chicago.
Polish Roman Catholic Union of America	1873	158,782	Chicago.
Polish Women's Alliance of America	1898	59,093	Chicago.
Protected Home Circle	1886	64,864	Sharon, Pa.
Red Men, Improved Order of	1834	300,000	Philadelphia.
Royal Arcanum	1877	81,461	Boston.
Royal Neighbors of America	1895	580,558	Rock Island, Ill.
Security Benefit Association	1892	165,044	Topeka, Kan.
Société des Artisans Canadiens-Français	1876	71,305	Montreal.
Standard Life Association	1914	60,700	Lawrence, Kan.
Travelers Protective Assoc. of America	1890	69,201	St. Louis, Mo.
United Commercial Travelers of America	1888	69,160	Columbus, O.
United Workmen of North Dakota, Anc. Ord.	1895	40,747	Fargo, N. D.
Woman's Benefit Association	1892	208,678	Port Huron, Mich.
Women's Catholic Order of Foresters	1891	62,608	Chicago.
Woodmen Circle, Supreme Forest	1892	129,712	Omaha, Neb.
Woodmen of America, Modern	1883	526,638	Rock Island, Ill.
Woodmen of the World	1890	48,486	Denver, Col.
Woodmen of the World, Sovereign Camp	1890	323,975	Omaha, Neb.
Workmen's Circle	1900	66,240	New York.
Workmen's Sick and Death Benefit Fund	1884	51,816	Brooklyn.

some chapters of which continue to have such exercises.

Each fraternity, when it had established several chapters, began to hold conventions, composed of delegates from the chapters. At first they were held at irregular intervals, then biennially or annually. For many years each fraternity was governed by a grand chapter, usually the parent chapter, which granted charters for other chapters, and maintained a unified policy of administration under direction of the convention. About 1870 the fraternities began to abolish the grand chapter form of government, and to vest administrative powers in executive committees or councils, composed of alumni. These boards, as legal corporations, hold title to the property of the fraternities. About the same time the larger fraternities began to divide their chapters into districts or provinces, with a subordinate executive officer for each. The fraternities are now strongly organized, and the general officers exercise efficient supervision over the chapters. The convention of each fraternity, which still holds supreme legislative power, amends its constitution, code of laws, and ritual. The National Interfraternity Conference of representatives of the general fraternities for men has met annually since 1909 to discuss questions of common interest.

All of the fraternities have alumni clubs in the larger cities, and some have more alumni clubs than chapters. These clubs are entitled to representation in the convention, but are not permitted to initiate persons to membership. They usually meet at irregular intervals for a reunion and dinner, although some of them meet regularly, and a few have club houses in New York City.

Chapter Houses.—In the early days the chapters met in rented halls, and usually they tried to keep secret the times and places where meetings were held. As the fraternities became stronger they began to erect houses. A cabin was built by Chi Psi at Michigan in 1846, and one by Delta Kappa Epsilon at Kenyon in 1854. The houses owned by chapters numbered 30 in 1883, 290 in 1905, and 513 in 1912; in 1929, 1,874, valued at $72.521,174. The sororities had 525 houses, valued at $18,157,200. Most of the other chapters live in rented houses. Many of the chapter houses have been built at great expense. Some of the finest are at Williams, Columbia, Cornell, Michigan, and Wisconsin.

General College Fraternities.

Year.	Name.	Where Founded.
1904	Acacia	University of Michigan
1895	Alpha Chi Rho	Trinity College (Conn.)
1920	Alpha Delta Alpha	Coe College
1832	Alpha Delta Phi	Hamilton College
1913	Alpha Epsilon Pi	New York University
1904	Alpha Gamma Rho	Ohio State University
1914	Alpha Kappa Lambda	University of California
1921	Alpha Kappa Pi	Newark College of Engineering
1916	Alpha Lambda Tau	Oglethorpe University
1914	Alpha Mu Sigma	Cooper Union Institute of Tech.
1912	Alpha Phi Delta	Syracuse University
1845	Alpha Sigma Phi	Yale University
1865	Alpha Tau Omega	Virginia Military Institute
1921	American Association of Commons Clubs	Denison University
1901	Beta Kappa	Hamline University
1917	Beta Phi Theta	Milwaukee State Normal School
1924	Beta Psi	University of Illinois
1910	Beta Sigma Rho	Cornell University
1839	Beta Theta Pi	Miami University
1854	Chi Phi	Princeton University
1841	Chi Psi	Union College
1919	Delta Alpha Pi	Ohio Wesleyan University
1890	Delta Chi	Cornell University
1844	Delta Kappa Epsilon	Yale University
1827	Delta Phi	Union College
1847	Delta Psi	Columbia University
1921	Delta Sigma Lambda	University of California
1899	Delta Sigma Phi	College of the City of New York
1859	Delta Tau Delta	Bethany College
1834	Delta Upsilon	Williams College
1825	Kappa Alpha Society	Union College
1865	Kappa Alpha (Southern)	Washington and Lee University
1905	Kappa Delta Rho	Middlebury College
1911	Kappa Nu	University of Rochester
1869	Kappa Sigma	University of Virginia
1909	Lambda Chi Alpha	Boston University
1912	Omicron Alpha Tau	Cornell University
1914	Phi Alpha	George Washington University
1912	Phi Beta Delta	Columbia University
1848	Phi Delta Theta	Miami University
1904	Phi Epsilon Pi	College of the City of New York
1848	Phi Gamma Delta	Washington and Jefferson
1889	Phi Kappa	Brown University
1852	Phi Kappa Psi	Washington and Jefferson
1850	Phi Kappa Sigma	University of Pennsylvania
1906	Phi Kappa Tau	Miami University
1920	Phi Lambda Theta	Pennsylvania State College
1918	Phi Mu Delta	Connecticut Agricultural College
1915	Phi Pi Phi	Chicago, Illinois
1910	Phi Sigma Delta	Columbia University
1873	Phi Sigma Kappa	Massachusetts Agricultural Col.
1868	Pi Kappa Alpha	University of Virginia
1904	Pi Kappa Phi	Charleston College
1895	Pi Lambda Phi	Yale University
1833	Psi Upsilon	Union College
1856	Sigma Alpha Epsilon	University of Alabama
1909	Sigma Alpha Mu	College of the City of New York
1855	Sigma Chi	Miami University
1921	Sigma Delta Rho	Miami University
1915	Sigma Lambda Pi	New York University
1921	Sigma Mu Sigma	Tri-State College
1869	Sigma Nu	Virginia Military Institute
1827	Sigma Phi	Union College
1901	Sigma Phi Epsilon	Richmond College
1908	Sigma Phi Sigma	University of Pennsylvania
1897	Sigma Pi	Vincennes University
1918	Sigma Tau Phi	University of Pennsylvania
1917	Square and Compass	Washington and Lee University
1910	Tau Delta Phi	College of the City of New York
1910	Tau Epsilon Phi	Columbia University
1899	Tau Kappa Epsilon	Illinois Wesleyan University
1856	Theta Chi	Norwich University
1847	Theta Delta Chi	Union College
1924	Theta Kappa Nu	Springfield, Missouri
1919	Theta Kappa Phi	Lehigh University

General College Fraternities—Continued.

Year.	Name.	Where Founded.
1870	Theta Nu Epsilon	Wesleyan University (Conn.)
1924	Theta Upsilon Omega	Lewisburg, Pennsylvania
1864	Theta Xi	Rensselaer Polytechnic Institute
1907	Triangle	University of Illinois
1898	Zeta Beta Tau	College of the City of New York
1847	Zeta Psi	New York University

Nomenclature.—The chapters of Phi Beta Kappa established at Yale and Harvard were called respectively the Alpha of Connecticut and the Alpha of Massachusetts. Several fraternities so denominate their chapters, or call the first chapter established in a State Massachusetts Alpha, for instance, the second, Massachusetts Beta, etc. Most fraternities, however, apply the Greek letters in alphabetical order to their chapters, in the order of establishment, without naming the State, and some designate chapters with Greek letters without any apparent order. When all letters of the alphabet have been so used, they are doubled, as Alpha Alpha, Beta Beta, etc., or two different letters are combined, as Alpha Beta, Alpha Gamma, or Beta Chi.

Insignia.—Kappa Alpha followed Phi Beta Kappa in adopting a square badge, but it was suspended from the corner instead of from one side. Later the badges of both were changed to the form of a watch key. The badges of other fraternities are usually of three general shapes—a lozenge, various forms of crosses, and various shapes of shields. Such badges display the Greek-letter name of the fraternity, and certain emblems, of which the most common are clasped hands, eye, skull and cross bones, scroll, keys, lamp, stars, and crescent. Nearly all fraternities have coats of arms, and some for each of their chapters. Nearly all have flags, colors, and flowers. Some have open as well as secret mottoes. Some have fraternity cheers, similar to college yells.

Publications.—Most fraternities have journals, which are published quarterly, monthly, or bi-monthly during the collegiate year. Each journal is named for its fraternity, as the *Magazine of Sigma Chi;* or for some feature of its badge, as the *Scroll of Phi Delta Theta;* or for the fraternity colors, as the Alpha Chi Rho *Garnet and White*. The oldest journal is the *Beta Theta Pi,* which was established in 1872. Most of the journals are open to all readers, but some are privately circulated. Several fraternities issue two journals each, one open and the other private. The first fraternity to issue a catalogue of its members was Sigma Phi in 1834; the first to issue a song book was Psi Upsilon in 1849. All fraternities have issued such books, which in some cases have run into many editions. Some have published manuals, and a few extended histories. A few also issue year books.

Professional and Honor Fraternities.—There are now many professional fraternities for students in the law, medical, scientific, dental, pharmaceutical, and agricultural departments of universities—such as Phi Delta Phi, law, organized in 1860 at the University of Michigan, and Nu Sigma Nu, medicine, 1882, University of Michigan. Besides Phi Beta Kappa there are two score other honor societies in various fields, including Sigma Xi (science), 1886; Phi Kappa Phi (scholastic), 1898; Order of the Coif (law), 1902; Mortar Board (women), 1918; Tau Beta Pi (engineering), 1885; Sigma Delta Chi (journalism), 1909; Delta Sigma Rho (forensics), 1906.

Sororities.—There are also many intercollegiate fraternities for women—or sororities, as they are usually called. All of these have Greek-letter names, and in organization are similar to the general fraternities for men. The first of them—Kappa Alpha Theta and Kappa Kappa Gamma—were founded in 1870. These and other societies, starting in co-educational institutions, quickly spread to many women's colleges, although they are still excluded from some prominent ones. In 1912 Mount Holyoke abolished local chapters. In 1913 Barnard College decided to prohibit initiations during a period of three years. Since 1891 the sororities have held a national pan-Hellenic conference every year.

Local Fraternities are to be found in many universities, notably at Yale, where a peculiar system of secret societies, with local fraternities for seniors, was early instituted—*e. g.*, Skull and Bones (1832), Scroll and Key (1841), Wolf's Head (1884), and Elihu Club (1906). Some other prominent local fraternities are Berzelius, 1863, and Sigma Delta Chi, 1876, Yale; Alpha Theta Chi, 1895, U. of Nebraska; Delta Psi, 1850, U. of Vermont; Kappa Kappa Kappa, 1842, Dartmouth; Lambda Iota, 1836, U. of Vermont; Phi Nu Theta, 1837, Wesleyan U.

The legal status of fraternities has been the subject of several court decisions. In a case affecting Purdue University, the supreme court of Indiana in 1881 admitted the right of privately endowed institutions to exclude fraternity members, but denied the right to institutions receiving State aid. In 1909 the supreme court of New York decided that a chapter may not be deprived of its charter unless it has violated a rule of the fraternity.

Bibliography.—Exhaustive information concerning fraternities, with a sketch of each, may be found in *Baird's Manual of American College Fraternities;* similar information concerning sororities in Ida S. Martin's *Sorority Handbook*. Consult also National Interfraternity Conference, *Proceedings;* T. A. Clark, *The Fraternity and the College*.

Fraticelli, frä-tē-chel'lē ('little brethren'), a sect of the Middle Ages which may be regarded as an embodiment, outside of the mediæval church, of the same spirit to which is due, within the church, the Franciscan order with its many offshoots. The Italian word *Fraticelli* originally was the popular name of the Franciscan monks; but in the progress of the disputes that arose in the order (see Franciscans), the name was specially attached to the members of the rigorist party, who eventually refused to accept the pontifical explanations of the monastic rule, and in the end threw off all subjection to the authority of the church. John xxii, against whom they sided actively with Louis of Bavaria, condemned them by a special bull in 1317. They regarded the existing church as in a state of apostasy, and claimed for their own community the exclusive title of the Church of God. They forbade oaths, and discountenanced marriage. They professed a divine mission for the restoration of the gospel truth. They held that all spiritual authority was forfeited by sin on the part of the minister. They maintained themselves in Central Italy down to the fifteenth century, when John of Capistrano received a commission to labor for their conversion in the March of Ancona; but before the beginning of the following century they seem to have disappeared.

Frattamaggiore, frä-tä-mädjō'-rā, town, Naples province, Italy; 8 miles by rail north of Naples, of which it is a residential suburb. Pop. 15,300.

Fraud, in law, signifies any dishonest means employed for the purpose of injuring another

or otherwise affecting an illegal design. For example, if a person knowingly makes a false statement or represents himself to be other than he really is, thereby causing another to contract with him, or takes advantage of the youth or defective mental capacity or intoxicated condition of another, he is obviously guilty of fraud. So, also, if an insolvent contrives to give one of his creditors an advantage over the rest, or if a husband and wife resort to collusive means of obtaining a divorce. It will thus be seen that fraud is a necessary element in a number of crimes and civil wrongs. (See DECEIT.)

There are several important limits to the application of the doctrine of fraud. It is a general rule that the law will assist only those who exercise reasonable care and precaution regarding their own interests. Thus, a purchaser is not generally entitled to complain if the article bought does not wholly come up to the laudatory description of it given by the seller, for he was bound to use his own discretion with regard thereto. But if the circumstances are such that the purchaser must rely on the statements of the seller, then the case may be different. Again, there is, as a rule, no duty on one party to reveal facts which are within his own knowledge, but of which the other is unaware. The purchaser of an apparently worthless picture may know that it is really of great value, but his silence on the matter is not regarded by the law as fraud. He is entitled to take advantage of his superior knowledge and acuteness. On the other hand, in certain contracts—*e.g.*, that of life insurance —the one party is dependent upon the other for his information, and on that account any concealment of material facts on the part of the latter is deemed fraudulent. Likewise in dealings between attorney and client, trustee and beneficiary, and other parties standing in a fiduciary relation the one to the other, the fullest confidence must be observed.

In order to constitute legal fraud it is not necessary that a party should make statements which he knows to be false for the deliberate purpose of misleading another, or that his conduct should be intentionally dishonest. If he shows any recklessness in making statements which he does not know to be true, or in acting in a manner calculated to produce a false impression, he will likewise be held responsible. Mere concealment of facts, in absence of inquiry regarding them, does not give rise to an action for deceit. In equity, however, if there is concealment of material facts by one in whom confidence was placed, a transaction may generally be set aside.

A party is entitled to set aside a contract into which he may have been induced to enter through another's fraud. If the victim of such dishonest practices has suffered any loss he can sue for damages in a court of law, and can also seek restoration of the *status quo* or relief against future detriment from a court of equity. While fraud, as already remarked, is an element in a number of crimes, yet at common law it is not in itself criminal unless of a public nature and directed against a number of persons or society as a whole. Thus a person cannot be indicted at common law for obtaining money or goods by means of false representations. But this defect of the common law has been remedied, both in the United States and in England, by the creation of the statutory offence known as False Pretences (q.v.). (See EQUITY; CONCEALMENT.)

Statute of Frauds.—The title originally given to an English statute of 1677 (29 Car. ii., c. 3), sections 4 and 17 of which have either been re-enacted or substantially followed in all of the United States. Therefore a person speaking of the Statute of Frauds usually refers to the statute in his own State containing similar provisions to the above.

Section 4 of the English act provided: 'No action shall be brought whereby to charge any executor or administrator upon any special promise, to answer damages out of his own estate; (2) or whereby to charge the defendant upon any special promise to answer for the debt, default, or miscarriage of another person; (3) or to charge any person upon an agreement made upon consideration of marriage; (4) or upon any contract for sale of lands, tenements, or hereditaments, or any interest in or concerning them; (5) or upon any agreement that is not to be performed within the space of one year from the making thereof; (6) unless the agreement upon which such action shall be brought, or some memorandum or note thereof, shall be in writing, and signed by the party to be charged therewith, or by some other person thereunto by him lawfully authorized.'

Section 17 provides: 'No contract for the sale of any goods, wares, or merchandises for the price of £10 sterling, or upward, shall be allowed to be good, except the buyer shall accept part of the goods so sold, and actually receive the same, or give something in earnest to bind the bargain, or in part of payment, or that some note or memorandum in writing of the said bargain be made and signed by the parties to be charged by such contract, or their agents thereunto lawfully authorized.' Fifty dollars is substituted for £10 sterling in the American statutes.

Some of the other provisions have been followed in the United States, but they are not so well known under the above title. See CONTRACT.

Frauenfeld, frou'*en*-fĕlt, chief town, Swiss canton of Thurgau; 26 miles by rail northeast of Zürich. It has textile and machinery industries. Pop. (1930) 8,795.

Frauenlob. See HEINRICH VON MEISSEN.

Fraulautern, commune, Rhine province, Prussia; 12 miles northwest of Saarbrücken. It manufactures tinware. Pop. 6,212.

Fraunce, a disease which attacks horses and hawks. In the former case, wart-like pimples are found on the palate; in the latter, froth collects about the beak.

Fraunhofer, froun'hō-*fer*, JOSEPH VON (1787–1826), German optician, was born in Straubing, Bavaria. In 1799 he was apprenticed to a glass cutter and polisher in Munich; and in 1807 he was employed to found an optical institute at Benedictbeuern, which a year later was removed to Munich. There he became a member of the Academy of Sciences in 1823, and was also appointed professor and conservator of the physical cabinet of the same institution. His more important inventions include a spherometer, a heliometer, a micrometer, an achromatic microscope, and the great parallactic telescope at Dorpat. He also effected improvements in the quality of telescopic prisms, and in the mechanism for manipulating telescopes of large size; and discovered the dark lines in the sun's spectrum, which bear the name of Fraunhofer lines (q.v.).

Fraunhofer Lines, dark lines in the solar spectrum, partially observed by Wollaston in 1802, and mapped in 1814 by Joseph von Fraunhofer (q.v.). He counted 600 of these hairlike streaks, and measured the positions in the spectrum of 324, affixing to a few of the more conspicuous lines letters of the alphabet (A to H), by which they are still distinguished. Their meaning remained myste-

rious until the discovery, by Kirchhoff and Bunsen, in 1859, of the principles of spectrum analysis. (See SPECTRUM.) Their interpretation has made us cognizant of the solar existence of about forty terrestrial elements, forming a 'reversing layer,' through which the photospheric radiance is sifted, and stamped with characteristic absorption. Dark lines thus show where beams have been subtracted by selective action; but their linear shape is simply due to the fact that they are images of a rectangular slit, employed to 'purify' the spectrum, which would otherwise be rendered featureless by the overlapping of rays from all parts of the light source. The best modern maps of the solar spectrum, executed photographically by Prof. Henry A. Rowland (q.v.) of Johns Hopkins University, include more than 10,000 Fraunhofer lines.

Fraustadt, frou'stăt, town, province Posen, Prussia; 14 miles northeast of Glogau. It has tanneries, sugar factories, and dye works, and manufactures cotton and woollen goods and hats. In 1706 it was the scene of the defeat of the Saxons and Russians by the Swedes under Charles XII. Pop. 7,556.

Fraxinus. See ASH.

Fray Bentos, frī bān'tōs (officially INDEPENDENCIA), capital of the department of Rio Negro, Uruguay, on the Uruguay River; 170 miles northwest of Montevido. It is noted for its manufacture of meat extract. Pop. 5,000.

Frayser's (FRAZIER'S) **Farm, Battle of,** also known as the BATTLE OF GLENDALE, one of the Seven Days' Battles (q.v.), was fought on June 30, 1862, about 12 miles southeast of Richmond, Va., between the Federal Army under McClellan and the Confederate Army under Lee. A part of McClellan's army entrenched here was attacked by a part of Lee's army. The actual attack was made, with great impetuosity, by Longstreet and A. P. Hill, who at first broke the Federal centre under McCall, but were finally driven back. The day was probably the most critical one during McClellan's change of base, and Lee lost his last real chance during the Peninsula Campaign to crush the Federal Army. During the night of June 30 the Federal forces proceeded to Malvern Hill (q.v.). See PENINSULA CAMPAIGN.

Frazee, frā'zē, JOHN (1790–1852), American sculptor, was born in Rahway, N. J., and in early life was a farmer and stone cutter in New Brunswick. Removing to New York City, he started a marble yard on Broadway (1819), and after making monuments for four years, turned his attention to sculpture. His first commission was a bust of John Wells for St. Paul's Church. In 1834 he executed busts of Daniel Webster, Prescott, Lowell, Story, and others for the library of Boston Athenæum, and afterward produced busts of Lafayette, De Witt Clinton, and General Jackson. He was one of the first Americans to give serious attention to the sculptural art.

Fra'zer, JOHN FRIES (1812–72), American scientist, was born in Philadelphia, Pa., of Revolutionary descent, and was graduated from the University of Pennsylvania (1830). In 1836 he became first assistant geologist of the first geological survey of Pennsylvania, and in 1844 superintendent of the coast survey, and professor of chemistry and natural philosophy in the University of Pennsylvania. He determined with accuracy the diurnal variations of the magnetic needle, and showed the connection between the aurora borealis and magnetism.

Frazer, PERSIFOR (1844–1909), American geologist, was born in Philadelphia. He was graduated from the University of Pennsylvania in 1862, and entered the U. S. Coast Survey. During the Civil War he served in the cavalry through the Gettysburg campaign, and was subsequently an ensign in the Mississippi squadron. In 1866–9 he studied at the school of mines at Freiberg, Saxony; in 1870–4 was professor of chemistry at the University of Pennsylvania; and in 1874–82 assistant in the second geological survey of Pennsylvania. He was the first foreigner to receive the doctorate of natural science from the University of France. He was the author of *Tables for the Determination of Minerals*, and of more than 300 papers and articles in scientific journals.

Frazer Island, or GREAT SANDY ISLAND, Queensland, Australia, between Wide Bay and Hervey Bay. It is about 65 miles long by 10 wide.

Frear, frēr, WALTER FRANCIS (1863), American public official, was born in Grass Valley, Cal. He was graduated from Oahu College, Honolulu (1881), Yale University (1885), and Yale Law School (1890). In 1893 he became second associate justice of the supreme court of Hawaii; in 1896 first associate justice; and in 1900 chief justice. In 1907 he was appointed governor of Hawaiian Territory.

Fréchette, frā-shet', LOUIS HONORÉ (1839–1908), French-Canadian poet, was born in Levis, Quebec. He was educated at Laval University and Nicolet College, and was called to the bar in 1864. In 1866 he removed to Chicago, where he was in charge of foreign correspondence for a railway company until 1871. He then returned to Canada, where he practised law until 1879, and was a member of the Dominion Parliament from Levis (1874–9). He edited several journals, and published prose works, plays, and translations into French; but his important productions were several volumes of poems, two of which were crowned by the French Academy in 1880. His volumes of verse include: *Mes Loisirs* (1863); *La Voix d'un Exile* (1869); *Pêle-mêle* (1877); *Les Fleurs Boréales* (1880); *Les Oiseaux de Neige* (1880); *Les Oubliés* (1886); *Voix d'Outre-mer* (1886); *La Légende d'un Peuple* (1887); *Les Feuilles Volantes* (1891); *Veronica*, a drama in five acts. These have proved their author the most sympathetic of the interpreters of Canadian scenery and of French-Canadian traditions and aspirations.

Freckles (sometimes called *Lentigo*) are small yellowish or brownish-yellow, irregularly rounded spots, from the size of a pin's head to that of a split pea, frequently seen on the skin, especially of fair or reddish-haired persons. They are not often met with under the age of six or eight. They are most common on the face, but often occur on the hands and sometimes elsewhere. They are always most distinct in summer; but though the influence of the sun's rays undoubtedly increases their distinctiveness, it is doubtful whether it can cause them. They are due to increased local deposit of pigment in the skin; and it may be noticed that persons subject to them do not bronze uniformly under the influence of exposure nearly so deeply as others.

Many methods of treatment have been advocated for their removal; but in most cases, at least, the improvement is not permanent. Among the milder measures which sometimes succeed in improving the condition is a lotion of hyposulphite of soda (15 to 30 grains) or of chloride of ammonium (15 grains), along with corrosive sublimate (½ grain to the ounce of water) applied to the part on rag or lint, or hypochlorite of sulphur ointment (one drachm to the ounce.)

Fredegond, fred'e-gond, or FREDEGUNDE (?545–597), mistress and afterward wife of Chilperic I., king of the Merovingian Franks. After separating Chil-

peric from his first wife Andovere. Fredegond is believed to have compassed the death of his second, Galsvintha, and then became his wife. She was involved in a bitter feud with Sigibert, king of Austrasia, and his wife Brunhilda, sister of Galsvintha. After instigating the murder of Sigibert, and removing all whose lives obstructed the succession of her son, afterward Clotaire II., she carried on a successful campaign against Brunhilda and her grandsons. See BRUNHILDA.

Frederic, HAROLD (1856–98), American novelist and journalist, was born in Utica, N. Y., joined the staff of the Utica *Herald* in 1876 and became its editor in 880. He was editor of the Albany *Evening Journal* from 1882 to 1884, and then went to London and acted as correspondent for the New York *Times* from 1884 until his death. His novels, for which he became widely known, include *Seth's Brother's Wife* (1887), *The Lawton Girl* (1890), *'n the Valley* (1890), *The Copperhead* (1894), and *The Damnation of Theron Ware* (1896), his masterpiece, and one of the most remarkable works in American fiction. All these, dealing mainly with life in New York State, contain fine character-drawing — a power which, with Frederic's abounding humor, creates the charm of the tales comprising *Marsena* (1895). Mr. Frederic visited Russia for the purpose of observing the anti-Semitic disturbances, and published an account of what he saw as *The New Exodus* (1892). Later books than those mentioned are *March Hares* (1896), *Gloria Mundi* (1898), and *The Market Place* (1899), the last of these being a romance based on the life of a notorious English 'financier.'

Fredericia, tn., S.E. Jutland, Denmark, on the Little Belt. It is the junction of the Jutland railways, and has steamboat communication with Fünen. Pop. 12,714.

Frederick, city, Md., co. seat of Frederick co., 50 m. N.W. of Washington, on the Pa., and the B. and O. R. Rs. It is the seat of the Woman's College (Ref. Church) and of the Maryland Institution for the Education of the Deaf. The industrial establishments include a large brush factory, canning factories, flour mills, knitting mills, sash factories, foundries, tanneries, bending works, brick works, creameries, etc. The water works and electric lighting plant are owned and operated by the municipality. The surrounding district is fertile, producing principally wheat and corn. Braddock Heights, six miles W. of the city, is a place of summer resort. Frederick was founded in 1745. It was the place of residence and burial of Francis Scott Key, author of the Star-Spangled Banner.' It was also the place of residence of Barbara Fritchie, the heroine of Whittier's poem. Pop. (1940) 15,933.

Frederick I. (1123–90), Holy Roman emperor, the first of the Hohenstaufen dynasty, known as 'Barbarossa,' was the son of Frederick, Duke of Swabia, and succeeded Conrad III. as emperor in 1152. For two years he busied himself in the settlement of Germany. That accomplished, he paid his first visit to Italy, received the Lombard crown at Pavia, and (June 18, 1155) was crowded emperor in Rome by Adrian IV., and executed Arnold of Brescia, the founder of the Roman commune. The year 1157 witnessed the beginning of Frederick's quarrel with the papacy. In 1158 the emperor crossed the Alps, compelled Milan to submit, and held a triumphant diet at Roncaglia. Revolts followed, and Milan sustained a siege of three years, which closed with its capture and destruction. In 1168 the Lombard League, an outcome of the enmity of the North Italian cities to the emperor, took final shape, and the town of Alessandria was built as a defence against German armies; and in 1176 the league was victorious over Frederick in the battle of Legnano. Pope Alexander III., by the peace of Venice (1177), forced his opponent to make full submission. Frederick was reconciled with the papacy, and in 1183 the peace of Constance closed the struggle with the Lombard League. During the years succeeding the peace of Venice Frederick broke the power of Henry the Lion, Duke of Saxony (1181), and divided the duchy; and in 1183, by the treaty of Augsburg, he arranged a marriage between his son Henry and Constance, daughter of Roger, king of Sicily. From this marriage sprang the union of Sicily with the empire. At the same time, owing to internal divisions, the Lombard League weakened, and Frederick's power in Italy revived. Being practically master of Germany and Italy, Frederick put himself at the head of the third crusade, but was drowned in a small stream in Cilicia. See Prutz's *Kaiser Friedrich I.* (1871–3); Raumer's *Geschichte der Hohenstaufen* (ed. 1878); Testa's *Hist. of the War of Frederick I.* against *the Communes of Lombardy* (1877); and Tout's *The Empire and the Papacy* (1903).

Frederick II. (1194–1250), Holy Roman emperor, the son of the Emperor Henry VI. and of Constance, heiress of Sicily, was born at Jesi, near Ancona, in Italy. On the death of his father (1197), Frederick's succession in Naples and Sicily was secured by Constance; but it was not till 1212 that, Otto IV. having been excommunicated, Frederick was elected emperor. He was not crowned until 1215. Brought up in Sicily, he had been affected by the half-Greek, half-Arabic civilization of that island. He was versed in geometry, astrology, and natural history; he knew many languages, and was interested in many literatures. He cared little for war, but delighted in diplomacy. Accusations were often made against his orthodoxy, and he was accused of scepticism. In 1226 Frederick renewed the ancient imperial claims over Lombardy. Pope Honorius III. prepared to support the Lombard cities, and his successor, Gregory IX. (1227–41), began the celebrated struggle between the papacy and the emperor. In 1228 Frederick entered upon a crusade, and was crowned king at Jerusalem. In the ensuing struggle with the papacy, Frederick neglected his duties in Germany, and devoted all his energies to establishing in his Sicilian kingdom 'a centralized bureaucracy, dependent upon himself.' Aided by the Lombard cities and by many German nobles, the papacy eventually won the day. See Kington's *History of Frederick II.* (1862); Schirrmacher's *Kaiser Friedrich II.* (1859–65); Winkelmann's *Kaiser Friedrich II.*, in *Jahrb. d. Deut. Gesch.* (1889–97); Raumer's *Gesch. d. Hohenstaufen* (ed. 1878); and Tout's *The Empire and the Papacy* (1903).

Frederick III. (1415–93), Holy Roman emperor, was born at Innsbruck, in Tyrol, being a member of the house of Hapsburg. He was chosen emperor in 1440. Though without energy and decision, Frederick was patient, fond of peace, and by no means incompetent. But his reign covered a difficult period, during which the Turks invaded Hungary and Italy, and the Hungarians occupied Vienna. He was unable to prevent George Podiebrad from seizing Bohemia, or Matthias Corvinus from possessing himself of Hungary. Switzerland escaped from his control, and Sforza took Milan. But he duped Charles the Bold, who wished to secure the royal title; he defeated the schemes of his opponents in Germany; and he gradually reunited the family territories of the Hapsburgs. From this time, indeed, the imperial dignity was almost hereditary in the house of Austria (Hapsburg). The marriage, too, of his son Maximillian with Mary of Burgundy was destined

to render the Hapsburgs one of the greatest dynastics in Europe. See Chmel's *Geschichte Kaiser Friedrichs IV.* (*III.*) (1840–3).

Frederick I. (1369 – 1428), elector of Saxony, was born at Altenburg, being the son of Frederick, margrave of Meissen; became on his father's death, in 1381, involved in disputes with his two brothers, with the result that the family territory was divided. He fought against the Lithuanians, the Hungarians, the Emperor Wenceslaus, and the Hussites. At first he was successful against the last named, and, as a reward for his efforts, the Emperor Sigismund made him elector and duke of Saxony in 1424. In 1426, however, he was disastrously defeated by the Hussites at Aussig.

Frederick III. (1463 – 1525), called 'the Wise,' elector and duke of Saxony, was born at Torgau, and succeeded his father in 1486. Wielding immense influence in German politics in the early years of the 16th century, Frederick of Saxony was a man of strong religious opinions. On the death of Maximilian I. in 1519, he was offered the imperial crown. He, however, threw all his influence on the side of Charles of Spain, who became emperor as Charles V. He had already, in 1502, founded the University of Wittenberg, and had appointed Luther and Melanchthon to two of the professorial chairs. After Luther's return from the Diet of Worms, Frederick took the reformer under his personal protection, though he never formally adopted the Protestant tenets.

Frederick the Great.

(Statue at Washington, presented to the United States in 1904 by Emperor William II.)

Frederick I. (1657–1713), king of Prussia, succeeded his father, the 'great elector,' of Brandenburg, in 1688. He warmly supported the League of Augsburg in its opposition to Louis XIV., and aided William III. in carrying out the revolution of 1688 in England. In order to secure Frederick's adhesion to the Austrian cause in the War of the Spanish Succession, the Emperor Leopold gave him the title of king of Prussia (1701). He was the founder of the University of Halle (1694); he in many ways improved Berlin; he added several small territories to Prussia, and was elected prince of Neuchâtel (1707). See Hedebur's *König Friedrich I. von Preussen*, Tuttle's *History of Prussia*, and Henderson's *Short History of Germany*.

Frederick II. (1712–86) king of Prussia, called 'the Great,' was born in Berlin; succeeded his father, Frederick William I., in 1740. In October, 1740, on the death of the Emperor Charles VI., whose dominions passed to his daughter, Maria Theresa, Frederick revived an obsolete claim to part of Silesia, invaded the province, and defeated the Austrian army at Mollwitz (April 10, 1741) and Chotusitz (May 17, 1742). Maria Theresa surrendered almost the whole of Silesia by the treaty of Breslau (June 11, 1742). Austria, however, gained such conspicuous successes in the next two years that Frederick renewed his alliance with France, and reentered the war in August, 1744, by invading Bohemia. His intervention forced the Austrian army to evacuate Alsace, but Frederick himself was driven from Bohemia, and in the next year was compelled to resist an invasion of Silesia. This he succeeded in doing by a great victory at Hohenfriedberg (June 5, 1745); and following the Austrians to Bohemia, he again defeated them, at Sohr (September 20). Finally, by a successful attack upon Saxony, the ally of Austria, he compelled Maria Theresa to renew the cession of Silesia by the treaty of Dresden (December 25).

In 1756, when Austria found allies in France and Russia, Frederick threw down the glove by invading Saxony, and thus commenced the famous Seven Years' War. His forces were decimated in fearful battles, and victory was almost as disastrous as

defeat. More than once Frederick thought of suicide as the only escape from the evils he had brought upon his kingdom. But when the outlook was almost hopeless he was saved by the death of Elizabeth of Russia, and by the exhaustion of France. Austria alone was powerless to overcome Frederick, and the treaty of Hubertsburg in 1763 allowed the Prussian king to retain his dominions intact. During the years of peace that followed, Frederick devoted himself to the work of domestic government. His greatest achievement in this period was the dexterous if unprincipled management of the first partition of Poland (1772), by which he acquired West Prussia. Almost equally noteworthy was his successful resistance to the ambitious designs of Joseph II. to add Bavaria to the Austrian dominions. Frederick appreciated the greatness of Washington during the American Revolutionary War, and was one of the first rulers to conclude a commercial treaty with the U. S. See Carlyle's *History of Frederick II.* (1858–65); Koser's *Friedrich der Grosse als Kronprinz;* Droysen's *Friedrich der Grosse* (1874–85); Kugler's *Hist. of Frederick the Great* (Eng. trans. 1877); Longman's *Frederick the Great and the Seven Years' War* (1881); and Reddaway's *Frederick the Great* (1904).

Frederick III. (1831–88), German emperor, was born at Potsdam, the only son of Emperor William I., and the husband of Victoria, Princess Royal of England, whom he married in 1858. As soon as he became crown prince (1860) he took up an independent line in political matters, and opposed Bismarck's policy on various occasions. In the war with Austria (1866), the crown prince commanded the second army of 115,000 men, which was at first stationed in Silesia, and which arrived at Sadowa just in time to turn the scale decisively against the Austrians. On the outbreak of the Franco-German War of 1870–1, the crown prince commanded 200,000 men, massed between Landau and Carlsruhe for the protection of South Germany. On Aug. 6, 1870, he attacked the defeated MacMahon's army at Wörth, and on the 11th he crossed the Vosges. In 1878, during the illness of the Emperor William, he acted as provisional regent; and, on the death of his father, in March, 1888, he became emperor as Frederick III., but three months later died from a disease of the throat. See *Lives* by Rennel Rodd (1888) and Gustav Freytag (1890).

Frederick V. (1596–1632), Elector Palatine, was the leader of the Calvinist party in Germany. He succeeded his father in 1610, and married Elizabeth, daughter of James I. of England, in 1613. When, in 1618, the Bohemians deposed the Emperor Ferdinand II., and chose Frederick as their king, a struggle, half political and half religious, began in Bohemia. Driven from Bohemia after his defeat at White Hill, near Prague (1620), Frederick found that the Palatinate was overrun by the Imperialists, and given to Maximilian of Bavaria, who received the title of elector. For the rest of his life Frederick was an exile.

Frederick, seven kings of Denmark, of whom the following deserve notice. FREDERICK III. (1609–70), second son of Christian IV., succeeded his father in 1648; engaged in two ruinous wars with Sweden (1658), which cost Denmark all her possessions in the Scandinavian peninsula. The turbulence and obstructiveness of the nobility hampered Frederick's well-meant efforts to inprove the condition of his people, till the two lower estates of the Copenhagen Rigsdag conferred upon him absolute sovereignty, as being the only means of saving the state (1660).—FREDERICK IV. (1671–1730), son of Christian V., whom he succeeded in 1699. During the earlier part of his reign he waged an intermittent war with Sweden, but relinquished all his acquisitions by the peace of Frederiksborg (July 3, 1720), in exchange for 600,000 thalers. He rebuilt Copenhagen, and relieved the wretched condition of the peasantry.—FREDERICK V. (1723–66), son of Christian VI., whom he succeeded in 1746. An enlightened despot, largely guided by the great minister J. H. E. von Bernstoff, Frederick established trade with the American colonies. —FREDERICK VI. (1768–1839), son of the imbecile Christian VII., whom he succeeded in 1808, after acting as prince regent from 1784. His participation in the Napoleonic wars led to the bombardment of Copenhagen by the British (1807), the capture of the Danish fleet, and ultimately the loss of Norway.—FREDERICK VII. (1808–63), son of Christian VIII., whom he succeeded in 1848. He restored parliamentary government in Denmark (June 5, 1849), but dealt tyrannously with the Schleswig-Holstein duchies.—FREDERICK VIII. (1843–1912), was born at Copenhagen, on June 3, 1843, the eldest son of Christian IX., whom he succeeded in 1906. He studied at Oxford, and in 1869 married Princess Luise of Sweden. His father died on January 29, 1906, and on the following day Frederick was proclaimed king at Copenhagen. He was a man of considerable wealth, but was popular with the people because of his democratic manners and his dislike of ostentation. King Christian X., his eldest son, was born in 1870; his second son, Charles, became King Haakon VII. of Norway in 1905.

Frederick I. (1754–1816), king of Würtemberg, was born at Treptow, in Pomerania, and succeeded his father in 1797. Having declared war against France, he saw his country invaded, and was forced (1801) to exchange Montbéliard and his possessions in Alsace for nine imperial towns and other territories, and was given by Napoleon the title of elector. In 1805, on the outbreak of war between France and Austria, Frederick fought for the French, and was rewarded at the treaty of Pressburg by some Austrian lands in Swabia, together with the title of king. By joining the Confederation of the Rhine, the new king obtained fresh territories. After Napoleon's overthrow at Leipzig (1813) Frederick joined the allies.

Frederick (1676–1751), king of Sweden, born at Kassel, third son of the landgrave Karl of Hesse-Kassel; entered the English military service, and commanded the Hessian corps in the War of the Spanish Succession. He married Ulrica Leonora, sister of Charles XII. (1715), and entered the Swedish service, and on the resignation of his consort (April 4, 1720) became king of Sweden. His reign was distracted by the struggles of the Hats and the Caps parties.

Frederick Charles, OF PRUSSIA (1828–85), nephew of the Emperor William I., born at Berlin, was known as the 'Red Prince.' Served in the Schleswig-Holstein War (1848); in the Austrian War of 1866 he helped to win the battle of Sadowa; and in the Franco-German War of 1870–1 he gained distinction at Thionville, Gravelotte, and St. Privat. He also drove Bazaine into Metz, which he invested; and after its capitulation he took Orleans, and dispersed the army of the Loire.

Frederick Louis (1707–51), Prince of Wales, the eldest son of George II.; created Prince of Wales (1729), Frederick lived on bad terms with his father. The opposition to Walpole found Norfolk House, the prince's residence, a useful centre; and round Frederick, in 1737, gathered Bolingbroke's followers.

Fredericksburg, city, Spottsylvania co., Va., 53 m. N. of Richmond, at the head of tidewater on the Rappahannock R., and on the Rich., Fred. and

Potomac, and the Pot., Fred. and Pied. R. Rs., and the Rappahannock R. Line to Baltimore and Norfolk. It is situated in a valley, surrounded by high hills, and has abundant water-power. The manufactures include paper, flour, woollen goods, wagons, leather, shoes, machinery, agricultural implements, etc. The water works and gas and electric light plants are owned and operated by the municipality. It is the seat of Fredericksburg College (Presb.). The National Cemetery, on Marye's Hill, contains 15,000 graves, and there is also a large Confederate Cemetery. There is a monument in honor of Washington's mother, who died here. Pop. (1940) 10,073.

Fredericksburg, BATTLE OF, a battle of the American Civil War fought at Fredericksburg, Va., on Dec. 13, 1862, between the Federal Army of the Potomac (numbering about 113,000) under Gen. Burnside and the Confederate Army of Northern Virginia (numbering about 78,000) under Gen. Lee. Burnside had replaced McClellan in command of the Army of the Potomac, near Warrenton, on Nov. 7; had reversed McClellan's plans, and with President Lincoln's sanction, had decided to operate against Richmond by way of Fredericksburg. By Nov. 16 Burnside was on the north bank of the Rappahannock, but the expected pontoons not having arrived, he was delayed in crossing, and meanwhile Gen. Lee occupied and fortified the coveted heights back of Fredericksburg. Though the Confederate position was almost impregnable, Burnside recklessly decided to attack. His right under Sumner was to operate against Lee's left under Longstreet, his left under Franklin to operate against Lee's right under Jackson, and much of his centre under Hooker to be held in reserve. Against the Confederate left, the strongest part of the line, was directed the principal attack; here Longstreet's troops occupied Marye's Hill, strongly fortified, at whose base was a stone wall which sheltered a large force of Confederate infantry. The ground over which the Federals would have to march in order to reach Marye's Hill was covered so well, said Lee's superintendent of artillery, 'that we will comb it as with a fine tooth comb. A chicken could not live on that field when we open on it.' Lee's right, however, had a much less advantageous position—Jackson had not had sufficient time to make thorough preparation for repelling an assault—and it was against Jackson, according to military authorities, that Burnside should have massed his troops. On the night of Dec. 11, Sumner and Franklin crossed to the S. side of the Rappahannock, and early on Dec. 13, Franklin, interpreting Burnside's orders to call only for a reconnoissance in force, sent Meade with one division against Jackson; Meade gained the crest of the hill, but was inadequately supported and was forced back. Later in the day the Federals made six determined, enormously costly, but totally unsuccessful attacks upon Longstreet. In one of these attacks, led by Hancock, 2,000 men (including 156 commissioned officers) were lost out of 5,000. On the night of Dec. 15 Burnside retired without opposition to the N. side of the Rappahannock; he was determined to renew the attack, though in this he was opposed by his principal officers, but his advance, impeded by heavy rain, ended in a fiasco, known in military history as the 'mud campaign.' Soon afterward Burnside gave way to Hooker. On Dec. 13 the Federals lost about 12,600 men, the Confederates about 5,400. Burnside's attack has been regarded as one of the greatest mistakes made by any prominent officer on either side during the war, and its repulse was one of the most appalling disasters suffered by a Federal army. See Johnson and Buel (eds.), *Battles and Leaders of the Civil War* (4 v. 1887); Henderson, *The Campaign of Fredericksburg*, Nov.-Dec., 1862 (1886); and Palfrey, *The Antietam and Fredericksburg* (1882).

Frederick William (1620–88), elector of Brandenburg, known as the 'Great Elector,' was born at Kōln on the Spree, and succeeded his father in 1640. By the treaty of Westphalia (1648) he received Magdeburg, Halberstadt, Kammin, and Minden. Taking advantage of a war between Sweden and Poland, he secured the independence of Prussia from Poland by the treaties of Wehlau (1657) and Oliva (1660); and when Louis XIV. entered upon his Dutch war (1672–8), Frederick William made a league against the French king, and by the battle of Fehrbellin in (1675) he cleared Western Pomerania of the Swedes. He was, however, by the treaty of St. Germain - en - Laye (1679), compelled to reinstate Sweden in Pomerania. His internal reforms were noteworthy. Agriculture was encouraged, a canal made between the Elbe and the Oder, and after the revocation of the Edict of Nantes (1685) over 20,000 Huguenots found a home in Brandenburg. Between 1679 and 1688 the aggressions of Louis XIV. led the Great Elector to take up an attitude of firm opposition to the policy of the French king. See Philippson's *Der Grosse Kurfürst* (3 vols. 1897–1903), and Tuttle's *History of Prussia*, 1134–1740 (1884).

Frederick William I. (1688–1740), king of Prussia, was born at Berlin, son of Frederick I., whom he succeeded in 1713. From the war with Sweden, in which he found himself engaged, he in 1720 gained the district of Pomerania between the Oder and the Peene, including Stettin and the islands of Wollin and Usedom. Henceforward he set himself to create an administrative system, to organize a powerful army, and to secure the duchies of Joliers (Jülich) and Berg. He encouraged agriculture, introduced into E. Prussia some 17,000 Protestant refugees from Salzburg, and reformed the finances. In the Polish Succession War a Prussian contingent aided the Austrians. See Paulig's *Friedrich Wilhelm I.* (2d ed. 1889), and Tuttle's *History of Prussia*, 1134–1740 (1884).

Frederick William II. (1744–97), king of Prussia, was the nephew of Frederick the Great, whom he succeeded in 1786. Shortly after his accession he invaded Holland in order to help his sister, the Princess of Orange; and in 1788 the Triple Alliance between England, Prussia, and Holland was formed. Frederick William, however, was with difficulty induced not to attack Austria, then at war with Turkey; and in 1790 he made the Convention of Reichenbach with the Emperor Leopold. In 1792 Prussia and Austria entered upon a war with the French republic, but anxiety to take part in the partitions of Poland (1793 and 1795) and jealousy of Austria weakened the Prussian efforts. In September, 1792, the French won the battle of Valmy; and in 1795, by the treaty of Basel, Prussia became neutral. Frederick William was extravagant, under the influence of mystics, and was intolerant. By the partitions of Poland large areas were added to Prussia. See Paulig's *Friedrich Wilhelm II.* (1896).

Frederick William III. (1770–1840), king of Prussia, son of Frederick William II., whom he succeeded in 1797. In 1806 he was overthrown by Napoleon in the battles of Jena and Auerstädt. The treaty of Tilsit (1807) completed the ruin of Prussia, which, despoiled of all its territories west of the Elbe, remained till 1813 dependent upon Napoleon. Civil and military reforms were, however, initiated by Stein, Hardenberg, Scharnhorst, and Gneisenau, and in 1813 Prussia definitely joined Russia in the war of

liberation. Though defeated at Lützen and Bautzen (May, 1813), the allies, reinforced by Austria, overthrew Napoleon at Leipzig (October, 1813). At the Congress of Vienna Prussia regained her lost territory, with sundry additions. Frederick William then joined the Holy Alliance; and though the *Zollverein* or customs union was established and many reforms inaugurated, he suppressed the liberal movements of 1823 and 1830, and checked the freedom of the press. See Hahn's *Friedrich Wilhelm III. und Luise* (3d ed. 1877).

Frederick William IV. (1795–1861), king of Prussia, succeeded his father, Frederick William III., in 1840. A talented man, disliking the bureaucratic government of Prussia, he, in 1845, formed constitutional schemes, and in 1847 summoned the 'United Diet' of Prussia. In 1848 the revolution broke out in Berlin, and the king posed as a German nationalist; but the excesses of the democrats irritated him, Berlin was overawed by troops, and by the end of the year Prussia was again a military monarchy. Frederick William then refused the imperial crown, and devised a new constitution for Germany. He received little support, and the convention of Olmütz (1850) proved a victory for Austrian diplomacy. In 1857 the king became insane, and resigned the government to his brother William. See Ranke's *Biographie Fr. Wilhelms IV.* (1878), and Petersdorff's *König Fr. Wilhelm IV.* (1900).

Fredericton, port of entry, N. B., Canada, cap. of the prov. and of York co., on the St. John R., and at the head of permanent navigation, 84 m. from the sea. It is the terminus of two branches of the C. P. R. R. and is on the Can. E. and two river lines. It is the seat of the University of New Brunswick and of the Provincial Normal School. It has a large lumber trade, and manufactures of mill machinery, iron castings, woodenware, leather, boots and shoes, etc. Pop. (1931) 8,830.

Frederiksberg, a suburban municipality of Copenhagen, Denmark, mainly residential. A military college is housed in the Frederiksberg palace. Pop. 76,231.

Frederikshald, tn. and seapt., co. Smaalenene, 60 m. S.S.E. of Christiania, Norway. It exports timber, fish, and granite. Under its walls Charles XII. of Sweden was killed in 1718. Pop. 11,936.

Frederikstad, seapt. tn., co. Smaalenene, S. Norway, 50 m. S. of Christiania, at the mouth of the Glommen. It exports timber, stone, and bricks, and manufactures bricks, tiles, and nails, and has railway works and shipbuilding. Pop. (1930) 14,053.

(1.) Vi., Chautauqua co., N. Y., 40 m. S.W. of Buffalo on the Dunkirk, Alleg. Val. and Pitts., and accessible to four other railroads at Dunkirk, 2 m distant. There are two large canning factories and important grape industries, including the making of grape juice and wine and the sale of vine roots. There are other nursery products, and grapes are shipped in great quantities in car loads. Among educational and philanthropic institutions are a State Normal School, Old Ladies' Home, and the Barker Library. The village was settled about 1805. It was one of the first places to utilize natural gas, which was employed in lighting the streets in 1821. The water works and electric light plants are owned and operated by the municipality. Fredonia is considered an example of the model village. Pop. 5,285. **(2.)** City, Kan., co. seat of Wilson co., 65 m. W.S.W. of Fort Scott, on the Fall R., and on the Mo. Pac., the A., T. and S. Fe and the St. Louis and S. Fran. R. Rs. It is the trade centre of a grain and live-stock district and has rich natural resources in timber, coal, gas, building stone, etc. Linseed oil and flour are the leading articles of manufacture. Pop. 3,040. **(3.)** Tn., Antioquía, Colombia, S. America, with coal mines. Pop. 11,000.

Freebench. Under the English common law, a form of dower by custom, not requiring assignment by the heir. The amount varied in different manors. It still obtains to a limited extent in certain manors unaffected by the English Dower Act of 1834. See DOWER, and HUSBAND AND WIFE.

Free Church of England, an Episcopal organization founded 1844, an outcome of the Oxford Tractarian movement. Its promoters sought to secure evangelical services on strictly Protestant lines, wherever needed, without alliance with the state. The first church planted was at Bridgetown, Devon, by the Rev. J. Shore. Its bishops have maintained consecration in the Canterbury line through the early American Episcopal Church. A yearly convocation is held.

Free Church of Scotland. See PRESBYTERIANISM.

Free Church Federation. A federation of dissenting churches in England, dating from the year 1892. The most important religious bodies included in the federation are the Congregational, Presbyterian, Methodist, and Baptist Churches, the Free Episcopal Church of England, and the Society of Friends. The main objects of the federation are, to facilitate intercourse and co-operation among the members, to advocate the New Testament doctrine of the church, and to defend the rights of the associated churches. The bodies represented in the national council have over 9,000 ministers, about 2,000,000 communicants, and nearly 3½ million Sunday-school scholars.

Freedmen's Bureau, or BUREAU OF REFUGEES, FREEDMEN, AND ABANDONED LANDS, a bureau of the U. S. War Department originally created by the Act of Mar. 3, 1865, to remain in existence for one year after the close of the Civil War. The establishment of such a bureau was rendered necessary by the presence within the Federal lines of vast numbers of negroes who had escaped or had been rescued from slavery, and of whom at least a million were at the time of the passage of the act dependent for support upon the Federal Government. The bureau was placed in 'control of all subjects relating to refugees and freedmen from rebel states,' and was authorized to assign from the confiscated or abandoned lands of these states forty acres to each male refugee or freedman, to whom possession was guaranteed for three years. At the head of the bureau there was a chief commissioner, under whom there was an assistant commissioner for each state of the Confederacy. Another bill, greatly enlarging the powers of the bureau, was passed by Congress in February, 1866, but was vetoed by President Johnson and failed to pass over the veto. Later in the same year a third bill was passed; this also was vetoed, but on July 16, 1866, the veto was overridden, and the bill became a law. The new bill, which was to continue in effect for two years, greatly increased the number of officials and considerably enlarged the powers of the bureau, which was directed to assume jurisdiction over all deprivations of the civil rights of freedmen in consequence of rebellion and was authorized to appropriate for the education of the freedmen the property of the Confederate States. The bureau withdrew from the various states on Jan. 1, 1869, except as regards its educational work, which was continued until 1870. Throughout its existence the bureau's chief commissioner was Gen. O. O. Howard. Though the principal officers were unquestionably men of probity and ability, desirous of doing all that was possible for the freedmen, a very large number of the minor officials were just as unquestionably corrupt, self-seeking, and

vicious, and on the whole it seems probable that the bureau did much more harm than good. It relieved much real suffering, but by its charities it undoubtedly demoralized the freedmen, who were taught an injurious dependence upon the Government, and, worse than all, it did much to antagonize the two races in the South. Consult Pierce, *The Freedman's Bureau* (1904), and *Report of Joint Committee on Reconstruction* (1866).

Freedom of the Press. See PRESS.

Freedom of the Will. See DETERMINISM.

Freehold. A freehold estate must be in lands or other hereditaments—as, for example, a rent charge—of free as opposed to copyhold tenure, and it must, in respect of duration, be uncertain. It may be in fee simple—*i.e.* to a man and his heirs—or in fee tail—*i.e.* to a man and the heirs of his body—or for life, or for the life or lives of another person or persons. A grant to A for life or until he becomes bankrupt confers a freehold, because A may never become bankrupt; but a grant to A for two hundred years, if he should live so long, does not confer a freehold, because the estate must terminate at a certain definite time. A term of years, however long, is not a freehold but a chattel interest in real property. See also ESTATES and TENURE.

Freehold, tn., N. J., co. seat of Monmouth co., 26 m. E. of Trenton, on the Cent. of N. J. and the Pa. R. Rs. It is a summer resort and the centre of a farming district. The battle of Monmouth, between the Americans under Washington and the British under Clinton, was fought here June 28, 1778. Pop. 3,233.

Free Imperial City (*Reichsstadt*) was a city, within the territories of the former German empire, which held its rights and privileges direct from the emperor without intermediary. When their privileges were swept away in 1803, there were 14 Rhenish and 37 Swabian free cities. However, Hamburg, Bremen, Lübeck, and Frankfort-on-Main retained their independence till Frankfort was annexed by Prussia in 1866; while the three Hanseatic cities voluntarily entered the German empire at its formation in 1871.

Freeland, bor., Luzerne co., Pa., 26 m. S. of Wilkesbarre, on the Lehigh Val. R. R. It is situated in an anthracite coal district, and has machine shops, silk mill, overall factory, and hame works. Pop. 6,197.

Free Libraries. See LIBRARIES.

Freeman, MRS. C. M. See WILKINS, MARY ELEANOR.

Freeman, EDWARD AUGUSTUS (1823–92), English historian, was born at Harborne in Staffordshire. In 1849 he published a *History of Architecture*, and followed with a number of works bearing on history and political science. Of these the best known are *The History and Antiquities of St. David's*, in which he was aided by the Rev. W. B. Jones (1856); *History and Conquests of the Saracens* (1856); *History of Federal Government from the Foundation of the Achaian League to the Disruption of the United States* (unfinished) (vol. i. 1863); *History of the Norman Conquest* (1867–79); *Historical Essays* (1871–92); *A General Sketch of European History* (1872); *Subject and Neighbor Lands of Venice* (1881); *Historical Geography of Europe* (1881); *Methods of Historical Study* (1886); *History of Sicily* (1891–4). *The History of the Norman Conquest* is Freeman's greatest work, and with Stubbs and Green he aroused historical interest in the history of England in the period preceding the Norman conquest. Freeman visited the U. S. in 1881–82, where he delivered a course of lectures, and as a result of this visit published *Introduction to American Institutional History* (1882), *Lectures to American Audiences* (1882), and *Some Impressions of the United States* (1883). He also wrote *George Washington* (1888). In 1884 he succeeded Stubbs as regius professor of modern history in Oxford. See Stephen's *Life and Letters of E. A. Freeman* (1895).

Freeman, JAMES (1759–1835), American clergyman, was born at Charlestown (now a part of Boston), Mass., and graduated in 1777 at Harvard. During the Revolution he was a prisoner of war at Quebec for two years. In 1782 he became lay-reader of King's Chapel, Boston, and, having adopted Unitarian views, persuaded the congregation to follow him, and he was consecrated by them minister of the church in 1787, the bishop (Protestant Episcopal) declining to ordain him. He retained the position until 1826. King's Chapel thus became the first Unitarian church in America. He was a founder of the Mass. Historical Society, and published a volume of *Sermons and Charges* (1832).

Freeman's Farm, BATTLE OF, a name by which the first battle of Saratoga (Sept. 19, 1777), during the American Revolution, is sometimes known. See SARATOGA.

Freemasonry. The Ancient and Honorable Society of Free and Accepted Masons, the oldest and most widely distributed secret society in the world, has an active membership of more than 2,000,000, attached to nearly 30,000 lodges, scattered through all so-called civilized countries except Austria and Russia. It is founded upon a belief in Divinity and, as a fraternity, inculcates a system of pure morality by forms, ceremonies and symbolism in which the relief of suffering, the cultivation of the virtues, and the search for truth are emphasized. As now organized the society dates from 1717, when the four remaining lodges in London met and formed a grand lodge. There are various theories of the origin of Freemasonry, but Masonic students and historians agree that, while the rites and symbols of the fraternity are of great antiquity, the society, as now constituted, is probably not quite two hundred years old. The fables which carry the fraternity back to the building of King Solomon's temple, to the era of Isis and Osiris in Egypt, or to the day of the deluge, may be dismissed without discussion. There is much less doubt, however, that the English associations of operative builders of the middle ages, in their traditions, peculiar customs, the possession of a grip and a password, and in other respects, marked the evolution and showed the influence of the earlier German and other Continental stone mason guilds which, for centuries, moved about Europe employing the secrets and skill of their craft in constructing the churches and cathedrals which still stand as monuments to their handiwork. The Roman colleges of artificers, likewise, left an impress through the Roman occupation of Britain. In the fourteenth and fifteenth centuries these associations of operative builders were first called Free Masons, because of the freedom granted them to work and dispose of the products of their labor. The word 'Accepted' came into use in the seventeenth century, when the guilds received as members others than operative builders, when speculative as opposed to operative Masonry took its rise. Some of the oldest Masonic records are the 'old charges' of the fourteenth century and the Watsone manuscript in the West Yorks Masonic Library. The preserved minutes of the Lodge of Edinburgh begin in 1599 and of the lodge at Kilwinning in 1642. The forerunner of the modern grand lodge was the general assembly of Masons held at York, in 926, under the patronage of Edwin, where a code of laws was adopted which became the basis of the operative craft constitutions. Later, in the seventeenth century, attracted, no doubt, by reasons which readily suggest themselves, many Englishmen, Scotchmen, and

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FREEMASONRY

1. Alexander-Washington Lodge, No. 23, F. and A. M., Alexandria, Va., over which George Washington presided as master. The chair in the East is that used by Washington when he presided over the lodge. The portrait on the left (looking from the East) is of Washington, made when he was President (1794), by Williams, of Philadelphia; that on the right is of General Lafayette, painted in 1784. The painting over the Junior Warden's chair, in the South, is a Masonic floor cloth, or emblem, painted by Chapman, a member of the lodge.
2. Scottish Rite Temple, Washington, D. C.

Freemasonry

others, attached themselves as 'accepted' members of the operative Free Masons and, in several directions in England, and Scotland, a marked change began to develop in some of the characteristics of the craft. Elias Ashmole (q. v.), an eminent antiquarian, was one who so allied himself, and it was from such additions to membership that speculative Masonry gradually added to what had been contributed by the operative builders until it became the survivor. Nowhere else than in the United Kingdom was Freemasonry, of either the operative or speculative type, then known in Europe. The seeds planted by the British workers' guilds, influenced by like organizations from north and south continental Europe, bloomed and bore fruit. With the revival in 1717, when four London lodges met and formed a grand lodge, there was only one degree and very little of the ceremonial, which took shape eight years later, when the three symbolic degrees of apprentice, craftsman and master, with the characteristic legend and a wealth of symbolism, were found in the field.

Not all the British Masonic lodges fell into line promptly on the reorganization of 1717. Although the eighteenth century ushered in the decline of the society as an operative institution and witnessed its reincarnation as a fraternity of speculative Freemasons, some lodges held to the old régime for many years, the Melrose (Scotch) lodge, dating from 1674, refusing to join the Grand Lodge of Scotland until 1891. Indeed. some lodges never gave up an independent existence, notably that at Alnwick, Northumberland, which had a career extending from 1701 for more than half a century.

The remarkable evolution of the forms, ceremonies, and symbolism of Masonry, between 1717 and 1725, has been attributed to the influx of new membership, to antiquarians, historians, and mystics who were attracted to the fraternity late in the seventeenth and early in the eighteenth centuries. One result was the rounding out of the Masonic symbolic degree ceremonials to substantially the forms in use today, except that the mysteries of the Master's degree have been divided between it and the Royal Arch, an outcome as Masonic historians have it, of the British Grand lodge schism, which divided the craft in the United Kingdom into two jurisdictions during the latter half of the eighteenth century. Traces of symbolism from operative Masonry are preserved by the craft, and superimposed on the work of Masonic ritualists and enthusiasts are contributions from the Rosicrucians, the Kabbalists, the Gnostics, the Pythagoreans, and from Egyptian, Greek, and Oriental philosophies.

With the revival of Freemasonry in 1717 came the inroads of membership from among the British gentry and nobility, and from the British army and navy officers. This, with the wide extension of British commerce gave the society a vogue, through the activity of the army and navy, in all parts of the world and was the prime cause of carrying the fraternity broadcast into Europe and America and the British colonies within little more than a decade. It was within the next fifteen years that the Masonic vogue grew so throughout France and England that the work of inventing more, erroneously styled 'higher,' degrees began, which, between 1740 and 1803, resulted in the creation of many so-called Masonic rites or systems, superimposed upon, or attached to, the original symbolic Masonry of three degrees which constitutes original Freemasonry and is universal. In none of the superstructures or Masonic degree annexes is there anything more than illustration, emphasis and embroidering of the lessons taught in the first three degrees.

The English rite of three degrees was carried to France in 1725, to Ireland in 1720, and to Scotland and Spain in 1727; to Germany, Pennsylvania and India in 1730, to the Netherlands and Prussia in 1731, to Massachusetts in 1733, and to Portugal, Norway, Sweden, Italy, South Carolina, and Georgia in 1735, by which date there were lodges in Philadelphia, Boston, Charleston, Wilmington, N. C., and Savannah. After England, France was the most active in spreading the fraternity, followed by the Grand Lodges of Pennsylvania, Massachusetts, Virginia, Ireland, Spain, the Netherlands and Germany.

The first Masonic lodge was established in New York in 1737, in Rhode Island in 1749, in Maryland and Connecticut in 1750, in Virginia in 1753, in North Carolina in 1754, in New Jersey in 1761, in Canada and in Maine in 1762, in Delaware in 1765, in Florida in 1768, in Vermont in 1781, in the District of Columbia and Ohio in 1783, in Kentucky in 1788, in Louisiana in 1793, in Michigan in 1794, in Tennessee in 1796 and in Mississippi in 1801. The Henry Price Provincial Grand Lodge, at Boston, 1733, and the Philadelphia Lodge, which initiated Benjamin Franklin in 1731, and subsequently became a grand lodge, were the 'mother grand lodges of America.'

The 18th century saw the rapid extension of Freemasonry throughout the world, and witnessed the creation, mostly by the French, of numberless so-called Masonic degrees, groups of which were co-ordinated into systems or rites, many of which are extinct, but one of which, 'the Scottish Rite' (Scottish in name only), has enjoyed a wide distribution, particularly in the Latin countries and in the United States. In all except a few Latin and Balkan countries, this rite makes no attempt to displace the primary authority of the English 'blue lodge' system of symbolic Masonry of three degrees, but superimposes itself upon it with grades conferred in separate bodies. Strangely enough, the Ancient Accepted Scottish Rite, as now constituted and called, is an American creation. The 25 'Scottish' degrees were brought from France to America in 1762 or 1763. In 1801, at Charleston, S. C., they were made the basis of the new system, the Ancient and Accepted Rite, by adding eight degrees and making the final or thirty-third the governing body. Within the past century this rite has invaded almost all civilized lands, in most instances conferring only the degrees from the fourth to the thirty-third.

In the United States the two principal Masonic rites are, first, the American; and, second, the Scottish rite. The symbolic lodge with its three symbolic degrees, under exclusive Grand Lodge jurisdiction, is the fountain of each. Lodge members may take the degrees in one or both, as they elect, or rather as they are elected. In the American system, after the lodge, comes the Royal Arch Chapter, with four capitular degrees; then the Council of Royal and Select Masters, with three cryptic degrees, and as a summit, the Commandery of Knights Templar, with three degrees. The Royal Arch Chapter contains three English and one American degree, grouped. In England the first and fourth are conferred separately. The other one is an honorary degree borrowed from symbolic lodge ceremonials. The Council degrees are an ingenious elaboration, based on some 'Scottish' grades; and the Templar Red Cross and Malta degrees of the Commandery are modifications and elaborations of Scottish Rite grades. The Scottish Rite confers the fourth to fourteenth degrees in Lodges of Perfection, the fifteenth and sixteenth in Councils of Princes of Jerusalem, the seventeenth and eighteenth in Rose Croix Chapters, the nineteenth to the thirty-second inclusive in Consistories of Sub-

lime Princes of the Royal Secret, and the honorary and active thirty-third degrees in Supreme Councils of the Rite. The like holds true respecting the latter rite in practically all countries. In the Dominion of Canada both the American and Scottish rites prevail.

In the United Kingdom the primitive English symbolic system ranks supreme, to which are attached, as side or supplementary degrees, the Mark Master and the Holy Royal Arch degrees. Knight Templary, in the Masonic sense, has no such vogue there as in the United States.

The Rite of Memphis, French, 1839, and the Rite of Mizraim, French, 1805, have a small, virtually dormant existence and only a nominal following in the United States.

Some of the Negro Free Masons in the United States have as straight a connection with the British Grand Lodge as the members of the recognized white lodges of the order. A number of Negro Masonic lodges, though not recognized by white grand lodges in the United States, are lineal descendants of lodges instituted by Prince Hall and his associates, Negroes, who were made Freemasons at Boston in 1775 in an English army lodge attached to the command of General Gage. One 'regular' Masonic lodge in the United States which admits negroes to membership, is Alpha, No. 16, Newark, N. J. There are also unrecognized negro Scottish rite bodies, deriving their authority from the Supreme Council of France in 1864, though earlier and similar bodies appeared, the origin of which is unknown, and there are two small white so-called Scottish rite bodies, the existence of which is ignored by foreign bodies as well as by the Northern and Southern Masonic Jurisdictions in the United States.

The Ancient Arabic Order, Nobles of the Mystic Shrine, to which only Masonic Knights Templar, or thirty-second degree members of the Scottish Rite, are eligible, is the Masonic 'play ground' of many thousand members of the more advanced degrees of the fraternity. The Mystic Order, Veiled Prophets of the Enchanted Realm, is a smaller but similar annex to the craft.

Many of the most advanced members of the fraternity are actively interested in the American branches of the Masonic Concordant Orders, the Royal Order of Scotland and the Knights of the Red Cross of Constantine.

In the American Masonic rite, the Lodge, Chapter and Council require a belief in the Deity from would-be members, while Commanderies of Knights Templar require a profession of belief in Christ as the son of God. The Ancient Accepted Scottish rite has degrees drawn from the old or Jewish dispensation, but, as practised in the United States, election to bodies conferring the so-called Christian degrees does not call, in all cases, for a profession of the Christian belief.

In August of 1939, prior to the outbreak of war in Europe, there were 3,661,531 Freemasons distributed as follows: United States, 2,530,663; Canada,174,052; Latin America, 16,175; Continental Europe, 38,670; England, 404,485; Scotland, 249,995; Ireland, 47,985; Australasia, 181,152; Asia, 11,866; Africa, 6,488. Members in Continental Europe (exclusive of England, Scotland, and Ireland) were distributed thus: Bulgaria, 470; Denmark, 7,677; France, 1,804 (Grand Lodge only); Greece, 5,056; Holland, 8,110; Jugoslavia, 961; Norway, 10,638; Switzerland, 3,957.

In 1940 activities of the order were greatly curtailed in Europe, especially in France where Freemasonry was forbidden by the Vichy government after the Republic's armistice with Germany.

In the United Kingdom and Scandinavia Freemasonry has long enjoyed the patronage of royalty, and in virtually all countries where the order exists its membership includes many distinguished citizens.

The Order of the Eastern Star, though not Masonic as sometimes supposed, is a secret sisterhood to which only Freemasons and certain women relatives are eligible for membership. See EASTERN STAR, ORDER OF.

Free Methodist Church. See METHODISM.

Free Port, a seaport town, in which either no duty is charged on imported goods, and where any operation of industry or commerce may be carried on without state or territorial imposts; or where, within a certain defined area, such operations may be carried on free of any duty, either fiscal or excise. The Chinese ports termed 'free' come under neither of these categories, but are simply open to foreign trade, no absence of duties being implied. Free ports arose from the need of central markets in trade routes, and as refuges from pirates. The number of such ports has been greatly diminished by the unification of customs, the raising of tariff walls in European countries, and the introduction of bonded warehousing (see BONDED WAREHOUSE). At the present time there are free ports or free port zones at Hamburg and Bremen, Copenhagen (1894), Hong-Kong, and Singapore.

Freeport, city in Illinois, the county seat of Stephenson County, located 114 miles northwest of Chicago on the Illinois Central, the Chicago and North Western, and the Chicago, Milwaukee and St. Paul railroads. It has two hospitals, an orphanage and a public library. Freeport manufactures include pumps, gas engines, toys, organs, wagons, hardware, windmills, coffee mills, churns and leather. Near the present site of Freeport a final stand against the white men was made by the famous Indian chief, Black Hawk, in 1833. The town was settled in 1835. Freeport was the scene of the most famous of seven celebrated debates in 1858 between Abraham Lincoln and Stephen A. Douglas. The population in 1930 was 22,045.

Freeport, village, Long Island, New York, Nassau county, on the Long Island Railroad; 25 miles east of New York City. It is a residential village with a large commuting population. Pop. (1910) 4,836; (1920) 8,599.

Free Presbyterian Church. See PRESBYTERIANISM.

Freer, frēr, CHARLES LANG (1856–1919), American art connoisseur, was born in Kingston, N. Y. He devoted his leisure and means to gathering collections of paintings and curios. In 1905 he offered to the United States Government, on terms that were later accepted, his art collections, including paintings, Chinese, Japanese, Corean, Babylonian, and Central Asian potteries, and the decorations of Whistler's famous 'peacock room,' together with a bequest of $1,000,000 to provide a suitable building for them in the Nation's capital. This building, a beautiful white stone structure in Italian Renaissance style, was opened in Washington, D. C., May 9, 1923

Freer, FREDERICK WARREN (1849–1908), American artist, was born in Chicago. He studied at the Royal Academy in Munich, and for several years lived in Europe. In 1880 he established a studio in New York City, and was elected an associate of the National Academy. In 1890 he returned to Chicago and became an instructor in the Art Institute. He was particularly successful in his portraits of women. Among his best-known works are *Souvenir of Gainsborough, In Ambush, Behind the Fan, A Lady in Black, The Mirror, Consolation,* and *The Young Mother.*

Free Reed, a kind of mechanism in use in certain musical instruments. There are various forms, but in all the tone is produced by the periodic vibration of a strip or *tongue*—usually of

metal—fastened at one end over an orifice only slightly larger than the tongue, and having the latter so adjusted that a current of air will cause it to vibrate without coming in contact with the edges of the orifice. See HARMONIUM; ORGAN; REED.

Freesia, frē'si-*a*, a genus of bulbous plants belonging to the order Iridaceæ, native to the Cape of Good Hope. The species from which the garden varieties have been derived is *F. refracta*, which bears nearly white, long, tubular flowers, the segments of the tube spreading horizontally at its mouth. The slender stem is bent like a shepherd's crook, and the fragrant flowers stand upright on the horizontal portion. Freesias make excellent room or conservatory plants, and are easily multiplied by seeds or division of bulbs. They thrive best in a well-drained light soil containing a certain proportion of leaf mould and well decayed manure. Freesias readily lend themselves to forcing. They are produced chiefly in Bermuda, California, and the Channel Islands.

Free Soil Party, a short-lived American political party which took part in two presidential campaigns—those of 1848 and 1852. The party was formed by a fusion of 'political Abolitionists' (q. v.), many of whom had previously been identified with the Liberty party (q. v.), and of that faction of the Democratic party in New York, known as 'Barnburners' (q. v.). In 1848 Van Buren and Charles Francis Adams were nominated for the presidency and the vice-presidency respectively on a platform which, though proposing 'no interference by Congress with slavery within the limits of any State,' declared for a policy of limiting, localizing, and discouraging slavery, asserted that Congress had 'no more power to make a slave than to make a king,' advocated the prohibition of slavery in the Territories, and closed with the frequently quoted words: '*Resolved*, That we inscribe on our banner, "Free Soil, Free Speech, Free Labor, and Free Men," and under it will fight on, and fight ever, until a triumphant victory shall reward our exertions.' In the ensuing election the party's candidates received 291,263 popular votes, but no electoral votes; the Free Soil canvass, however, undoubtedly caused the defeat of Cass (Democrat) and the election of Taylor (Whig). After this campaign the 'Barnburners' reunited with the Democrats, and in 1852 the Free Soilers cast only 156,667 votes for their presidential candidate, John P. Hale. Subsequently the Free Soilers, generally, united with other political groups to form the Republican party (q. v.). Consult T. C. Smith's *The Liberty and Free-Soil Parties in the Northwest.*

Free Spirit, BRETHREN OF THE, a fanatical sect which sprang up along the Rhine early in the thirteenth century and spread into France, Switzerland, Italy, and the Netherlands. They promulgated pantheistic doctrine and were accused of immoral conduct. In 1306 and following years energetic measures were taken against them, and they disappeared.

Freestone, a term applied to those rocks which are finely granular, uniform in texture, without well-marked lines of bedding, and which split readily in any direction, whether along the beds or across them. Freestones dress readily, are suitable for carved work, and may be used for massive architecture, as they are uniform, and give solidity of appearance to the masonry. Most freestones are varieties of sandstone (q. v.). Such are the Berea sandstone of Ohio or the Hinckley stone of Minnesota. Portland freestone and Bath freestone of England are oölitic limestones similar to the widely used Bedford oölite of Indiana.

Freetown, capital and chief town of the British colony of Sierra Leone, West Africa, on the Sierre Leone River, about 5 miles from the coast. It has streets and well constructed business and dwelling houses. The most notable edifices are the Cathedral, the fruit market, the Government offices, Princess Christian Cottage Hospital, and Fourah Bay College, an institution founded by the Church Missionary Society and since 1876 affiliated with Durham University. The barracks of the British forces are situated on a hill back of the town. Freetown has an excellent harbor and an export trade in rubber, nuts, palm oil, and fruits. Pop. (1938) 63,572.

Free Trade. Freedom of trade, as the term has been used since the time of Adam Smith (q. v.), means the removal of all restrictions on commerce that favor one form at the expense of another. It involves, in particular, the equal treatment of home and foreign productions. Under this system no preference is shown to either class, and consumers may choose the most suitable articles without having to pay a penalty for their selection. Encouragements to or restrictions on the export of commodities are a violation of the free-trade principle, since they tend to disturb natural economic conditions.

The policy of free trade rests on a few broad general propositions which are amply supported by experience. (1) The private individual is the best judge of his own interest in matters of trade, or, at the lowest, is a better judge than any government can be. (2) In the pursuit of his private interest, each individual directs his commercial dealings in a manner, on the whole, more conducive to the general interest than if he were guided by state control. (3) As consumption is the end and aim of all production, what is beneficial to the consumers must be for the interest of the community. (See INTERNATIONAL TRADE.) Freedom affords the widest possible scope for international specialization of industry. Each country, by abandoning or diminishing those branches of production in which it finds itself at a disadvantage, is able to use all its industrial powers in the most suitable directions. Manufactures, in particular, will gain by concentration in the most favorable situations. Improved organization under the system of large production increases output and reduces cost. Even in agriculture and mining, the drain on natural agents, through increased demand, will lead to the opening up of fresh areas, and to the adoption of the most approved methods. Free trade, in fact, allows of the highest return being obtained from the natural agents, labor and capital, employed in production.

By a great many persons free trade is regarded as a theory incapable of being reduced to practice, and various exceptional cases have been suggested in which a departure from the rule of freedom may be desirable. The fact that the policy of most civilized nations is hostile to free trade raises, it is maintained, a presumption against it which is entitled to consideration. Indeed, even among free traders there is a disposition to regard the matter as one involving very complicated issues.

The most important exception on economic grounds is the case of new industries. These, it is held, require the protection of the state in their earlier years in order to overcome the initial difficulties that hamper all fresh enterprises. Such assistance at the outset will be more than repaid in the future when the industries become a source of profit to the community. The real difficulty in this class of cases is to discover the proper objects for encouragement. To avoid selecting any industries but those that (1) need and (2) will ultimately repay the fostering care bestowed on their infancy, calls for the gift of prescience in a degree not possessed by any gov-

ernment, and least of all by those of the modern democratic type. Nor does carefully interpreted experience give force to the plea. Alike in the United States and in Australia the evidence in its favor is of the slightest.

Of somewhat similar character are the departures from free trade proposed in order (1) to increase or retain population and capital, or (2) to preserve the exhaustible natural resources of a country. Each is only capable of application under very stringent limitations, rarely, if ever, realized in practice.

Another group of exceptions is based on political or social considerations, such as the advantages of diversified industry, the necessity of maintaining high wages, or the supreme interest of national defence.

In most instances the end sought is desirable, but the question remains whether it might not be equally or even better attained under free trade, without the sacrifices that state intervention involves. But, taken in the most liberal sense, these several exceptions cover a comparatively narrow area; the broad practical rule of free trade remains intact as, on the whole, the best policy for the modern civilized state. The reasons which have led to the adoption of a restrictive system by so many countries are best treated under PROTECTION, but here it should be stated that an *economic* justification for their procedure is wholly wanting.

In Great Britain there has been since 1903 an active revival of the earlier 'fair-trade' agitation under the title of 'tariff reform.' The arguments used are, in essence, protectionist, but the pleas often used are those of meeting unfair competition and of securing true or real free trade. The most interesting theoretical points in the controversy are (1) the possibility of levying duties which will fall on the foreign producer; (2) the effect of the law of increasing return, which, it is alleged, enables a protected foreign industry to produce a larger quantity at lower cost in consequence of the larger market which such an industry possesses.

The expression 'free trade' has been often employed in other senses as meaning (1) freedom to export without restriction by the action of privileged companies or by the state, or (2) the complete removal of taxes on commodities. The expression 'free trade in land' means the abolition of the legal restrictions on transfer. See Dudley North's *Discourses on Trade* (1691), perhaps the earliest exposition of free trade views; Adam Smith's *Wealth of Nations* (1776); *The Merchant's Petition* (1820) clearly summarizes the free trade case; Bastiat's *Economic Sophisms* (trans. 1888); H. Fawcett's *Free Trade and Protection* (1881) and W. G. Sumner's *Protectionism* (1885) are later statements of the free trade position. Also see: Frank W. Taussig, *Free Trade, the Tariff, and Reciprocity* (1919), *Selected Readings in International Trade and Tariff Problems* (1921), *International Trade* (1927), and *The Tariff History of the United States* (rev. ed. 1931); Cordell Hull, *American Foreign Trade Policies* (1936); and Jacob Viner, *Studies in the Theory of International Trade* (1937). See RECIPROCITY; GOVERNMENT CONTROL; TARIFF; and INTERNATIONAL TRADE.

Free Will Baptists. See BAPTISTS.

Freezing is the process by which a liquid takes the solid form. This is usually effected by cooling the liquid, or taking heat from it. The temperature at which in any given case this change takes place is called the freezing-point. At this same temperature, under the same physical conditions, the solid will liquefy; hence the freezing-point is the same as the melting-point, or point of fusion. It is usual to speak of substances which are ordinarily liquid as having freezing-points, and substances which are ordinarily solid as having melting-points. The freezing-point of water (or melting-point of ice) is chosen as one of the convenient temperatures for forming a temperature scale. This temperature is called zero on the Centigrade or Celsius scale, and is marked 32 on the Fahrenheit scale.

Freezing-points are affected by change of pressure, being lowered (as in the case of water) when the substance expands on freezing, and raised (as in most other cases) when the substance contracts on freezing. The lowering of the freezing-point of water is only 0.0075 of a degree Centigrade for an extra atmosphere of pressure. It is sufficient, however, to give to ice some of its most important physical properties. Skating is possible because of the lowering of the freezing-point under pressure, the ice melting momentarily under the narrow edge of the skate. Glacier ice flows down valleys because of the melting at the points where the pressure is greatest. This melting at once relieves the pressure, and the water refreezes, moulding itself to the form of the surface.

When a salt is dissolved in water the freezing-point is lowered. Thus, sea-water freezes at a lower temperature than fresh water. But what freezes is simply the water, the substance held in solution being, so to speak, frozen out. This separation of the solute from the solvent means work done—hence the necessity for abstracting more heat from the solution. The facts connected with the depression of the freezing-points of solutions have led to an interesting theory, in which the ionization or dissociation of molecules plays an important part. The pathologist has found the phenomenon of the depression of the freezing-point of blood useful in diagnosis. See SOLUTIONS.

FREEZING MIXTURES are combinations of substances which by their mutual action produce cooling. The most familiar is the mixture of snow and salt. The result is to produce liquid brine—that is, snow or ice is melted and the salt is dissolved. But both processes involve the absorption of heat. This heat is taken from objects in the immediate neighborhood and from the mixture itself. A mixture of salt and snow in the proportion of 33 to 100 lowers the temperature by 20° C. A solution of 6 parts of ammonium nitrate in 10 parts of water produces cooling through 27°. Seven parts of snow and 10 of crystalline calcium chloride reduces the temperature by 55° C. When solid carbon dioxide is dissolved in ether or chloroform, a temperature of − 77° C. is obtained.

Freiberg, tn., Saxony, at the N. foot of the Erzgebirge, 25 m. by rail S.W. of Dresden. It is the centre of the Saxon mining industry, and has a famous mining academy, founded in 1765. The cathedral (1484) contains the burial vaults of the electors of Saxony from 1541 to 1694. Gold, silver, bismuth, zinc, nickel, cobalt, sulphuric acid, and arsenic are produced. Pop. 30,175.

Freiburg, Switzerland. See FRIBOURG.

Freiburg-im-Breisgau, tn. and archiepisc. see of Germany, grand-duchy of Baden; is beautifully situated at the W. foot of the Black Forest, 39 m. by rail N.E. of Basel. It trades in timber and wine, and produces silks, cottons, buttons, beer, machinery, etc. It is the seat of a university (2,029 students in 1904–1905), founded in 1460, and, since 1821, of a Roman Catholic archbishop. The cathedral is one of the most remarkable in Germany. The town is backed by the castle hill, formerly surmounted by two castles, which were destroyed by the French in 1744. It was besieged more than once in the 17th century, and passed to Baden in 1806. Pop. (1939) 111,860.

Freights, OCEAN. Ocean freighting may be classified under charter and line traffic. The staple articles, as wheat, lumber, coal, ores, etc., are as a rule assembled in vast quantities at the ports of shipment; their production is for the most part very irregular, fluctuating from season to season and from year to year. To accommodate this class of business a great number of slow-sailing vessels have been built, which are held by their owners subject to charter by any shipper who may need their service. Since these vessels go from port to port in search of freight, they are commonly known as tramps. Intense competition for freights is the rule in the charter business, and rates fluctuate to an extraordinary degree. During the Boer War high freights resulted in a great overproduction of tramp ships, and until 1903 rates were so low that scarcely more than running expenses were earned, and complete recovery to normal conditions was delayed until 1905. Numerous attempts at combinations to maintain rates have been made, but none of these have been in any degree successful.

Manufactures and perishable products are generally carried by line vessels. The freight rates are as a rule much higher, and the practice of agreements as to the fixing of rates is more common. These agreements do not, however, present the stability of agreements among land carriers. As a rule only a limited number of commodities are covered by agreements; competition between lines for the greater number of articles is intense, with consequent fluctuation in rates. As much of this kind of freight is light relatively to bulk, it is common for line vessels to complete their cargoes with bulky staple articles, thus entering into competition with charter vessels. Such articles are often carried for almost nothing, being necessary for ballast.

Freight classification in the trade between the United States and England is almost unknown. Each shipping company decides from week to week the rate at which goods shall be carried. The German lines fix from year to year freight classifications for the west-bound traffic, which are rigidly adhered to; but heavy freight is ordinarily excluded from such classifications. Consult Giffen's *Essays on Finance* (1880–86); J. Russell Smith's *Organization of Ocean Commerce* (Publ. of the Univ. of Pennsylvania, 1905), and 'Ocean Freight Rates' (*Political Science Quarterly*, June, 1906). For the freight rates from month to month in the American-European trade, see *Monthly Summaries of Commerce and Finance* (Washington, Dept. of Commerce and Labor).

Freiligrath, FERDINAND (1310–76), German poet, born at Detmold. The success of his first collection of *Gedichte* (1838) encouraged him to devote himself altogether to literary work. In 1848 he became editor of the *Neue Rheinische Zeitung* in Cologne and went to England in 1851 to avoid being arrested on account of his *Politische und soziale Gedichte* (2 vols. 1849–51). His verses include *Ça Ira* (1846) and *Zwischen den Garben* (1849). He translated Longfellow's *Hiawatha* in 1857. A collected edition of his works, in 6 vols., appeared in 1877, and there is an edition of his works up to 1858, which was published in 6 vols. in New York in 1858–59. For his life, see Buchner's *F. Freiligrath* (1881), and G. Freiligrath's *Erinnerungen an F. Freiligraths* (1889).

Freischütz, in German legend, a marksman in possession of magic bullets (*Freikugeln*), six out of seven of which are, by the devil's agency, destined to hit any mark chosen by their owner; the seventh is, however, at the disposal of the devil, and must hit the mark chosen by him. The legend was most widespread from the 14th to the 16th century. Appearing in Apel's *Gespensterbuch* (1810), it was afterwards utilized by Weber in the opera *Der Freischütz* (1821). See Grasse's *Die Quelle des Freischütz* (1875).

Freising, anc. tn. and episc. see, Bavaria, on the Isar, 26 m. by rail, N.N.E. of Munich, with which it gives title to a Roman Catholic archbishop. Its cathedral dates from the 12th century. It possesses also an agricultural school, and a famous brewery. Pop. 10,090.

Frelinghuysen, FREDERICK (1753–1804), American soldier and politician, was born in Somerset co., N. J., and graduated at Princeton in 1770. At the age of 21 he began to practise law, and in 1775 he was chosen to the Provincial Congress of New Jersey, and was appointed on the committee of public safety. By his re-election the following year, he became a member of the constitutional convention into which the congress was reorganized. He was very early active as a soldier of the Revolution, and recruited an artillery company, of which he was chosen captain. In that position, and while still a member of the Provincial Congress, he took part in the battle of Trenton. According to tradition, it was his pistol-shot that killed Rahl, the Hessian colonel in command. As colonel of a New York regiment, in 1777, he served under Washington, and the following year took part in the battle of Monmouth Court House. The same year, against his protest that he was too young, he was elected to the Continental Congress, and he was elected again in 1782. From 1783 to 1793 he devoted himself to the practice of his profession, with such success that in 1793 he was elected to the U. S. Senate. When President Washington called out the militia for the suppression of the Pennsylvania Whiskey Insurrection, he served as major-general. In 1796 he resigned his seat in the Senate for personal reasons.

Frelinghuysen, FREDERICK THEODORE (1817–85), American politician, was born in Millstone, N. J., and, on the death of his father, was adopted at the age of three by his uncle, Theodore Frelinghuysen. He graduated at Rutgers College in 1836, was admitted to the practice of law three years later, continuing with his uncle and succeeding to his large business after his relative's removal to New York two years later. As city attorney of Newark (1849), legal representative of the New Jersey Central R. R., the Morris and Essex Canal Co., and of other corporations, and attorney-general of the state from 1861 to 1866, he rose to eminence in his profession. In 1860 he served with distinction in the Peace Congress at Washington. Frelinghuysen served the unexpired term of William Wright in the U. S. Senate from 1866–69. He took a conspicuous part in opposing the policy, and favoring the impeachment, of Pres. Johnson. In 1870 he declined the mission to England for personal reasons. In 1871 he was elected to the U. S. Senate. During his career in the Senate he was a prominent advocate of a protective tariff, the Civil Rights bill, the restoration of the gold standard, and of means to prevent a dispute over the presidency, which at the close of his term occurred in the Hayes-Tilden controversy, in the course of which he was made a member of the Electoral Commission. Pres. Arthur, in Dec., 1881, appointed Frelinghuysen secretary of state, a position which he held for the remainder of the presidential term.

Frelinghuysen, THEODORE (1787–1862), American legislator, son of Frederick Frelinghuysen (q.v.), was born in Somerset co., N. J. In opposition to his youthful preferences for farm management, he was sent to Princeton, where he graduated with high honors in 1804. He began to practise law at Newark, N. J., in 1808, but during the War of 1812 he was in command of a company of volunteers. In 1817 he be-

came attorney-general of New Jersey, and had served twelve years when he was elected to the U. S. Senate as a Whig. He was a conspicuous advocate of the chief measures of the National Republican (afterward Whig) party—a protective tariff and the rechartering of the U. S. bank. For his discussion on the proposed removal of the Indians beyond the Mississippi, and his opposition to Sunday mail transportation, he was spoken of as the 'Christian statesman.' After his retirement at the end of his term, he was in 1836 and 1838 elected mayor of Newark. In 1839 he was chosen chancellor of the University of New York, and held that position until 1850. He was nominated by the Whigs for Vice-President, on the ticket with Henry Clay, in 1844, and defeated. He was eminent as the head of several religious organizations, being president sixteen years of the American Board of Commissioners for Foreign Missions and of the American Bible and Tract Societies. In 1850 he became president of Rutgers College, N. J., and held that position at his death.

Fremantle, seapt. tn., W. Australia, at the mouth of the Swan R., 12 m. below Perth. It is the first and last port of call in Australia for all European mail steamers. It has manufactures of soap, tin, leather, tobacco; sawmills and boat-building. Pop. 24,000.

Fremantle, Sir Edmund Robert (1836–1929), British rear admiral, born in London; served in the Burmese War (1852), and in the Ashanti War of 1873. Raised to the rank of rear admiral (1885), he was commander-in-chief in the E. Indies (1888–91), in China (1892–5), and at Plymouth (1896–99). He published *Naval Tactics, Lives of Hawke and Boscawen* and *The Navy as I Have Known It* (1905).

Fremantle, William Henry (1831–1916), English ecclesiastic. He became (1866) rector of St. Mary's, Bryanston Square, Marylebone. Later he was Bampton lecturer at Oxford (1883); was appointed (1882) to a canonry at Canterbury, and became dean of Ripon in 1895. Among his publications are *Reconciliation to God through Jesus Christ* (1870); *Lay Power in Parishes* (1870); *The Gospel of the Secular Life* (1882); *The World on the Subject of Redemption* (Bampton Lectures, 1885); and with Albert Grey, *Church Reform* (Imperial Parliament Series, 1887).

Frémiet, Emmanuel (1824–1910), French sculptor, born at Paris; pupil of Rude; was first known as a sculptor of animals. He then produced a series of statues and groups, mainly equestrian, among them *Joan of Arc* (1874), at Paris; *Condé* (1881); *Joan of Arc* (1889), at Nancy; *Velasquez*, at Paris; and *Lesseps* (1900), at entrance to Suez Canal. Latterly, M. Frémiet dealt with imaginary figures and scenes, several of them drawn from animal life—*e.g. Gorilla carrying off a Woman* (1887). See *Life*, in French, by Biez (1900).

Fremont, (1.) City, O., co. seat of Sandusky co., 30 m. S.E. of Toledo, at the head of navigation on the Sandusky R., and on the L. Erie and W., the Wheel. and L. Erie, and the L. Shore and Mich. S. R. Rs. It is situated in the oil and gas fields, and has manufactures of muslin underwear, carbons, furniture, stoves, suspenders, storm fronts for vehicles, machinery, farming tools, wagons, lime, flour, cutlery, etc. Fort Stephenson was erected here in 1812, and the following year an attack by the English and Indians was repulsed. The town was called Lower Sandusky until 1850, when it was named in honor of John C. Frémont. The place was the home of Pres. Hayes. Pop. 9,939. (2.) City, Neb., co. seat of Dodge co., 32 m. N.W. of Omaha, on the Platte R., and on the U. Pac. and the Chi. and N. W. R. Rs. It is an important grain market and has dairying and live-stock industries, and machine shops, planing and flour mills, sugar, furniture, incubators, and harness factories, brewery, publishing house, etc. Pop. 8,718.

Frémont, John Charles (1813–1890). American explorer. He was born at Savannah, Ga., and was educated in Charleston under private tutors. He displayed extraordinary ability as a student, especially in mathematics, and in his sixteenth year was admitted to the junior class in Charleston College, whence, however, he was shortly expelled for conduct prejudicial to college discipline. Early in 1833 he was appointed to give instruction in mathematics to the midshipmen on board the sloop *Natchez*. At the end of a two-and-one-half year cruise he presented himself before the board of naval examiners at Baltimore to qualify for the position of professor of mathematics and engineering in the navy. He passed his examination with distinction, whereupon the authorities of Charleston College conferred upon him the degrees of A.B. and A.M. He received his appointment, and was assigned to the frigate *Independence*, but resigned immediately to accept a post as civil engineer under Captain Williams of the United States topographical engineers, who was engaged in the survey of a route from Charleston to Cincinnati. The winter of 1837–38 he spent in a survey of the Cherokee country, and in July, 1838, he was commissioned as second lieutenant of topographical engineers. During the remainder of 1838 and the greater part of 1839 he was engaged, under the explorer Nicollet, in a survey of the territory between the Mississippi and Missouri, up to the British line. In the spring of 1841 he was placed in charge of a small expedition with instructions to explore the Des Moines River. Returning to Washington, he secretly married the daughter of Senator Thomas H. Benton of Missouri. In the summer of 1842 he entered upon the first of his five great exploring expeditions. He was instructed to explore the country lying between the Missouri and the Rocky Mountains, along the line of the Platte. This task he performed successfully, penetrating through the great South Pass, of which he prepared the first adequate description. In the spring of 1843 he set out on a second expedition, under instructions to connect his surveys of the previous year with those of Commodore Wilkes on the Pacific coast. The expedition was a long and hazardous one, extending to the fall of 1844. In its course he reached the tidewater of the Columbia; then striking southeast, and again west, reached the Sacramento Valley, having made extensive explorations in the Great Basin. His report on the Great Salt Lake region is said to have determined the Mormons in their choice of this region for settlement; and his report on California was an important factor in exciting American interest in that country, which, it was then believed, Great Britain was planning to annex. In the spring of 1845 he was again sent upon an expedition to the Pacific coast, ostensibly to explore the coast regions to the north of California. Early in 1846 he arrived in California, and requested permission of the Mexican governor to encamp for the remainder of the winter. The request was granted; but his suspicions having been aroused by Frémont's activity in surveying the country, the governor ordered him to proceed no farther, and prepared to expel him from Californian soil. Frémont entrenched himself on a mountain overlooking Monterey, whereupon the governor gave up his plan of attacking him. To avoid hostilities Frémont withdrew toward Oregon, but was soon recalled to California by an agent of the United States, to protect American interests there in case of the anticipated outbreak of hostilities with Mexico. Emboldened by Frémont's presence,

certain Americans resident in California made an attack upon a small body of Mexican soldiers, and captured the town of Sonoma, raising a flag with a representation of a bear upon it—hence the name of the uprising, the 'bear-flag revolt.' Upon news that war had been declared against Mexico, Frémont enlisted a battalion of volunteers and proceeded to subjugate the territory, in co-operation with Commodore Stockton, whom he recognized as his commanding officer. In the fall Brigadier-General Kearny arrived from New Mexico, with orders to subjugate California and organize a civil government there. Stockton refused to surrender the command, and Frémont, who had been promised the governorship of the territory by Stockton, refused to acknowledge Kearny as his commanding officer, although the latter's claim was, by virtue of his superior rank, incontestable. On January 16, 1847, Stockton commissioned Frémont governor of the territory. In March Kearny ousted Frémont as a usurper and ordered him to Washington, where he was court-martialled, found guilty of mutiny, disobedience, and conduct prejudicial to military discipline, and sentenced to dismissal. President Polk remitted the sentence of dismissal, and allowed Frémont to resign from the service.

Statue of 'Alma Mater' at Columbia University, by Daniel C. French.

In October, 1848, he set out on his fourth expedition, planning to find a direct route to California from the headwaters of the Rio Grande. He was unable to do this, and after great privations turned southward and entered California by the Gila route. In 1850 he was elected Senator from California for the short term. In 1853 he joined an expedition engaged in surveying a route between the 38th and the 39th parallels for a highway to the Pacific. This work occupied the fall of 1853 and the spring of 1854. In 1855 Frémont removed to New York city, in order to prepare for publication an account of his explorations. In 1856 Frémont was nominated for the Presidency by the Republican party, but through failure of the party managers to placate the old Whig elements by the adoption of a protectionist plank, he was defeated. Upon the outbreak of war in 1861 he accepted a commission as major-general of volunteers, taking command of the Union forces in Missouri. His arbitrary action in placing the state under martial law, and in proclaiming the emancipation of slaves belonging to rebels, created considerable embarrassment for the administration, which was still seeking to placate the South; he was also charged, but apparently unjustly, with military inefficiency. After one-hundred days' service he was relieved of his command. In 1862 he was placed in command of the so-called mountain district, in Kentucky, Tennessee, and Virginia. Dissatisfaction arose with his conduct of military operations, and his corps was incorporated in the Army of Virginia under General Pope, whereupon Frémont resigned. In 1864 he was nominated for the Presidency by a radical faction of the Republican party, but withdrew his name before the election. After the war he engaged in an unsuccessful project for a railway from Norfolk, Va., to San Diego, Cal. In 1878–81 Frémont was governor of Arizona; in April, 1890, he was appointed major-general and placed on the retired list. He died on July 13, 1890. Frémont's career has been the subject of much controversy, and not a little of the biographical material concerning him is obviously biased. The best sources to be consulted, however, are his own *Memoirs of My Life* (1887); Mrs. Frémont's *Souvenirs of My Time* (1887); the *Lives* by Bigelow (1856), and by Upham (1856), and Rhodes's *History of the United States from the Compromise of* 1850 (1893). See also CALIFORNIA.

Fremont Peak, highest mountain of Wyoming, in the Wind River group, W. part of Fremont co. It was ascended and measured by Frémont. Alt. 13,790.

French, ALICE ('Octave Thanet') (1850–1934), American author, born at Andover, Mass., graduated at the Abbott academy in that place. She early removed with her father, Judge Henry French, to Davenport, Ia., where, and at Clover Bend, Ark., she afterward lived, obtaining the material for her stories of the South and West. She published *Knitters in the Sun* (1887), *Expiation* (1890), *Otto the Knight* (1891), *Stories of a Western Town* (1893),

An Adventure in Photograpny (1893); *The Missionary Sheriff* (1897); *A Book of True Lovers* (1898); *The Heart of Toil* (1898); *A Slave to Duty* (1900); *The Man of the Hour* (1905); *The Lion's Share* (1907); *By Inheritance* (1910); *Stories that End Well* (1911); *A Step on the Stair* (1913); *And the Captain Answered* (1917).

French, DANIEL CHESTER (1850–1931), American sculptor, was born in Exeter, N. H., of New England descent, and obtained his education there and at the Massachusetts Institute of Technology. He received preliminary instruction in modelling from J. Q. A. Ward, but was for the most part self-educated. He attended anatomy classes in Boston, and had already executed the *Minute Man* (1875) at Concord, Mass., when he visited Florence for a year's study. There he worked in the studio of Thomas Ball. Returning to America in 1876, French passed two years in Washington, and from 1878 to 1887 resided in Concord and Boston. In the latter year New York became his permanent residence, though he frequently visited Paris for study and comparison. He became a member of the National Academy in 1902 and a chevalier of the Legion of Honor in 1910.

French's work, which is preeminently American, exhibits great versatility, ranging from simple portrait busts to colossal groups and statues. Among his best known productions are busts of Emerson, Bronson Alcott, and John Boyle O'Reilly; statues of John Harvard, Rufus Choate, General Washington, General Lewis Cass, Abraham Lincoln, General Grant, and George Hoar; the groups *Dr. Gallaudet and his First Deaf-Mute Pupil, Europe, Asia, Africa, and America* in front of the New York Custom House, *Death and the Sculptor*, the colossal statue of the *Republic*, exhibited at the Chicago Exposition, *Alma Mater* for Columbia University, and the statue of Lincoln for the Lincoln Memorial in Washington.

French, JOHN DENTON PINKSTONE, FIRST EARL OF YPRES (1852–1925), British general, was born in Ripple, Kent. After serving several years in the Navy (1866–70), he entered the Army in 1874. He was with the Nile expedition (1884–5), and was present at Abu Klea, Gubut, and Metammah. In 1899 he proceeded to South Africa, and joined Sir George White's force in Natal. Lord Roberts placed him in command of the cavalry division which had been mobilized at Modder River in 1900 and which, under his command, accomplished the relief of Kimberley (Feb. 15, 1900). He then joined in the chase of Cronjé, whom he forced into the deathtrap at Paardeberg (Feb. 27), and bore the brunt of the Boer attack in the battle of Diamond Hill (June 11, 12). When Lord Kitchener took over the supreme command on Nov. 29, General French was appointed to the command of the Southern Transvaal. In 1901–07 he commanded the 1st Army Corps at Aldershot, in 1907–11 was inspector-general of forces, and in 1913 was made field-marshal. He was commander of the British Expedi-

General John French, First Earl of Ypres

tionary Forces in France in the Great War (1914–5) but after the battle of Loos (September) retired in favor of General Haig, and was commander-in-chief of the forces in the United Kingdom in 1915–8. In 1919–21 he was Lord-Lieutenant of Ireland. He received the K.C.B. and K.C.M.G. for his services in South Africa, and was awarded an earldom after his resignation as Lord-Lieutenant of Ireland.

French, MANSFIELD (1810–76), American educator and philanthropist, was born in Manchester, Vt., and received his education in Bennington, Vt. He early removed to Ohio, and was concerned in the founding of Marietta College and other Ohio educational institutions. Joining the Methodist Episcopal Church in 1845, he was from then until 1848 president of Xenia (Ohio) Female College, and subsequently acted as agent for Wilberforce University, the first institution in America to admit negroes for instruction. He edited a religious monthly periodical, *The Beauty of Holiness*, which he transferred to New York City in 1858. There he took up an active abolitionist propaganda. He formulated the plan of improving the condition of the contraband negroes by education, and in 1862 organized the National Freedman's Relief Association, of which he was made general agent. The following year he headed a party of teachers which began work at Port Royal, S. C., and which, in spite of opposition, achieved considerable results.

French, WILLIAM HENRY (1815–81), American soldier, was born in Baltimore, Md. He was graduated from West Point in 1837, and entered the artillery. He served in the Seminole War in 1837–8, later on the frontier, and in the Mexican War, in which he was successively brevetted captain and major for gallantry. Soon after the beginning of the Civil War he was commissioned major in the regular service and brigadier-general of volunteers. He was brevetted for gallantry at Fair Oaks, Antietam, and Chancellorsville, was brevetted major-general for gallant and meritorious service during the war, and attained the rank of major-general of volunteers. After the war he served in the artillery and was commissioned colonel in the regular service. He was retired in 1880.

French and Indian War (1754–63), that part of the Seven Years' War fought in America between France and Great Britain. After the close of King George's War (q. v.), there was nominally peace between the American colonies of the two powers, but their claims were irreconcilable, and further hostilities were inevitable. The principal contention was with regard to the region west of the Alleghanies, which was claimed by both. In 1749 Céloron took formal possession of the Ohio Valley in behalf of Louis XV., and in 1753 Governor Dinwiddie of Virginia sent Major George Washington to warn the French away from this region. In the same year the French established Fort Duquesne on the site of the present Pittsburgh, Pa., and in April, 1754, Washington was sent to expel them; he, however, after a collision with the French at Great Meadows, was forced to surrender at 'Fort Necessity' and to return to Virginia. This was virtually the beginning of the war: 'the firing of a gun in the woods of North America,' it has been said, 'brought on a conflict which drenched Europe in blood.' England did not formally declare war, however, until May 18,1756.

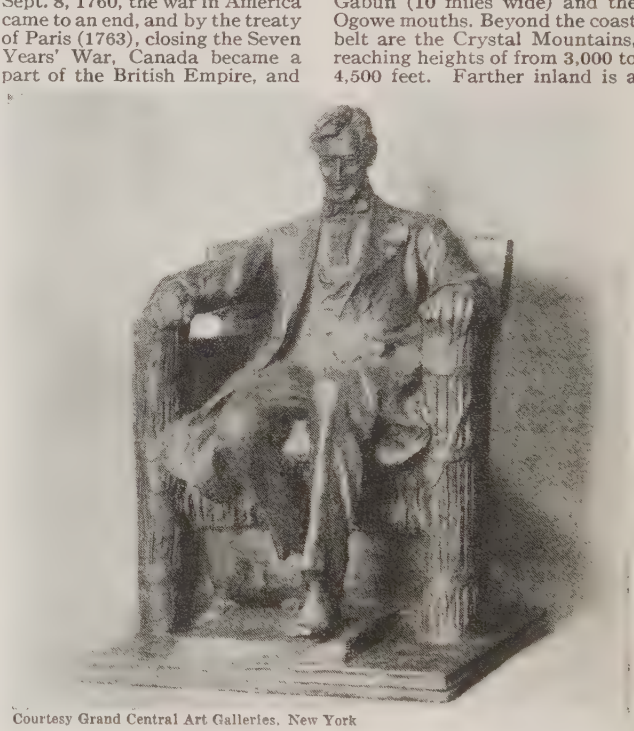
In numbers the English colonists had an enormous advantage; their estimated population was 1,100,000, whereas that of the French was only 80,000. The French, however, were highly centralized, were more thoroughly organized for war, and had the

assistance of superior numbers of Indians; the English were conspicuously decentralized—the various colonial governments were unable to work in harmony, and within each colony the official government generally met with much popular opposition, the governor frequently being at odds with the elected legislative assemblies. The French, moreover, had the advantage of acting along interior lines.

In 1754 delegates from the New England colonies and from New York, Pennsylvania, and Maryland, met in Albany, N. Y., to draw up a plan of colonial union and to make a treaty with the Iroquois (see ALBANY CONVENTION), and the co-operation of the Six Nations was secured. In 1755 the British planned a simultaneous attack on Fort Duquesne, Nova Scotia, Crown Point, and Fort Niagara. The attack on Fort Duquesne, under Gen. Edward Braddock, failed disastrously, the British force being totally defeated (July 9, 1755) about 8 miles from the fort (see BRADDOCK, EDWARD). The expedition against Nova Scotia succeeded, and, as a military measure, the Acadians were deported (1755); but the expeditions against Crown Point and Fort Niagara failed, though during the former the British, under Sir William Johnson, defeated the French under Dieskau (q. v.), in the battle of Lake George (Sept. 8, 1755); this expedition, says Parkman, was 'a failure disguised under an incidental success.'

During 1756 and 1757 the French under Montcalm were successful in repelling attacks and secured Oswego (July 14, 1756) and Fort William Henry (Aug. 9, 1757), the surrender of the latter being followed by the massacre of many of the English by the Indian allies of the French (see WILLIAM HENRY). In 1757, however, William Pitt, on becoming the head of the British ministry, infused new vigor into the conduct of the war on the part of Great Britain. At the outset he planned the capture of Louisbourg (preliminary to the capture of Quebec), of Ticonderoga, and of Fort Duquesne; and he appointed General Abercrombie to replace Loudoun, who had previously been in chief command in America. In 1758 the British were on the whole successful. General Amherst captured Louisbourg (July 27), General Bradstreet captured Fort Frontenac (Aug. 27), and General Forbes occupied Fort Duquesne (Nov. 25), which had been abandoned by the French before his arrival; but General Abercrombie met a disastrous defeat (July 8) on his attempt against Ticonderoga. In 1759 the British were even more successful. General Wolfe defeated Montcalm on the Plains of Abraham (Sept. 13), both Wolfe and Montcalm losing their lives, and Quebec, on Sept. 18, was surrendered to the British. In July and August both Ticonderoga and Crown Point, abandoned by the French, fell into the hands of General Amherst; and Fort Niagara was captured by Sir William Johnson (July 24). With the surrender of Montreal to General Amherst on Sept. 8, 1760, the war in America came to an end, and by the treaty of Paris (1763), closing the Seven Years' War, Canada became a part of the British Empire, and the French at last retired from the North American continent.

Consult Parkman's *Montcalm and Wolfe* (2 vols.); Winsor's *The Mississippi Basin;* Bradley's *The Fight with France for North America;* Casgrain's *Montcalm at Lévis.*



Courtesy Grand Central Art Galleries, New York

LINCOLN, BY DANIEL CHESTER FRENCH

French Berries, the unripe berries of *Rhamnus infectorius,* one of the buckthorns. The berries are imported from France, and also from Persia, whence they are sometimes known as Persian berries, and are used to dye morocco yellow.

French Broad River. See TENNESSEE RIVER.

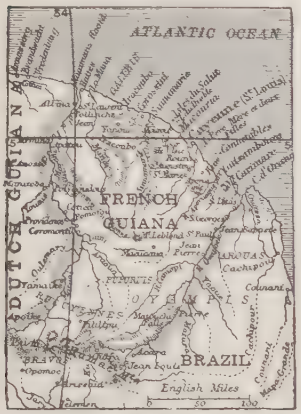
French Congo. See FRENCH EQUATORIAL AFRICA.

French Equatorial Africa, formerly known as the FRENCH CONGO, a colony on west coast of Africa, lying along the Atlantic Ocean between Nigeria and the Belgian Congo and Kabinda, and bounded on the east by the rivers Mbomu, Ubangi, and Congo. It is divided into four administrative districts—Gabon, Middle Congo, Ubangi Shari, and Chad, to which Kamerun (q. v.) was added following its occupation in the Great War. The area of the colony, exclusive of Kamerun, is 982,049 square miles. The low-lying coast is diversified by the estuary of Gabun (10 miles wide) and the Ogowe mouths. Beyond the coast belt are the Crystal Mountains, reaching heights of from 3,000 to 4,500 feet. Farther inland is a plateau rising to nearly 3,000 feet, cleft by deep river valleys.

The natural resources of the colony include huge forests of valuable wood, and deposits of gold, copper, zinc, and iron. The principal products are rubber, ivory, palm oil, coffee, vanilla, tobacco, copal, and cocoa. The chief towns are Libreville, the capital, Loango, Franceville, and Brassaville. The population was 3,418,066 in 1936.

The Gabon district was discovered by the Portuguese in 1470. The first French settlement was made in 1843 and Libreville was founded in 1849. French possessions were gradually extended inland and along the coast, and in 1910 the name was changed from French Congo to French Equatorial Africa.

French Guiana, or CAYENNE, French colony on the N.E. coast of S. America, separated from Dutch Guiana by the River Maroni and the Aoua (Itany), and from Brazil by the Oyapok and the Tumuc Humac-range. Its surface and geology are similar to those of the other Guianas, except that there is high ground near the sea. Other rivers are the Aprouague, Cayenne, Sinnamarie, and Mana, all obstructed by falls. About 5,630 men are confined at Devil's Island, famous French penal settlement near Cayenne. Agriculture is of minor importance, gold-mining being the chief industry. Leading exports are gold, bananas, and tropical woods; chief among imports are manufactured goods and foodstuffs. Area, about 34,740 sq. mi.; population (1936) 30,906. The capital and port is Cayenne. The first French settlers landed in 1604. Despite the Nazi defeat of France, the colony's integrity was assured by the Pan-American Conference of 1940 at Havana, 21 nations pledging mutual military aid against foreign aggression.



French Guiana.

French Guinea, colony of France on the W. coast of Africa, lies between Sierra Leone and Portuguese Guinea, and stretches from the Atlantic inland to about 7½° W. The coast lands are low and flat. About eighty miles inland begins the highland region of the Futa Jallon, rich in cattle and gold. The principal products are india-rubber, rice, millet, palm nuts, earth-nuts and fruit. Total trade (1938) $10,382,992, chiefly in gold and fruit exported and in fabrics and metal goods imported. The area is 89,436 sq. mi. Pop. (1939) 2,058,442. It was separated from Senegal in 1893, and its present boundaries were fixed in 1899.

French Indo-China. See INDO-CHINA, FRENCH.

French Language and Literature. See FRANCE.

French Polish. See POLISHES.

French Revolution, THE. The intellectual movement of the 18th century, connected with the names of Montesquieu, Diderot, Voltaire, and Rousseau, prepared men's minds for the problems which the Revolution was to force upon the attention of the world. But the principal causes of the French Revolution were rather political and economical than intellectual. The continual misgovernment of France since the death of Louis XIV., and the constant irritation felt by the middle and lower classes at the existence of the relics of feudalism, led the Third Estate to seize the opportunity afforded by the bankruptcy of the government to insist upon drastic changes in the administration. Recognizing the necessity for reorganizing the financial resources of France, and for revising the whole system of taxation, Louis XVI. had consented to the summoning of the States-general. On May 5, 1789, the first States-general since 1614 met at Versailles. Sweeping aside the obstacles placed in its way by the nobles, the higher clergy, and the court, the Third Estate declared itself the National Assembly. An attempt of the court to effect a *coup d'état*, which included the dismissal of Necker, and the suppression of the revolution by force of arms, was answered by the Paris mob by the capture of the Bastile (July 14). The king then yielded on all points, and till 1792 the Revolution was carried through by the middle classes, who placed the government of Paris in the hands of Bailly and Lafayette.

The first duty of those in power was to check the riots which were taking place all over France, and to draw up a constitution. On Aug. 4, 1789, all feudal rights, together with privileges of every description, were abandoned. Then a Declaration of the Rights of Man was drawn up, the king was given a suspensive veto, and it was settled that the Assembly should consist of only one chamber. Fearing lest the king should escape, and dissolve the Assembly, and believing that the king's presence in Paris would lower the price of bread, a mob of men and women marched to Versailles on October 5, and on the following day brought the king and royal family to Paris. The king and National Assembly were now in the power of the Parisians, the royal family being practically imprisoned in the Tuileries, and the Assembly sitting hard by in the *manége*, or riding-school. From October, 1789, to September, 1791, the French National Assembly busied itself with framing a constitution, and in carrying out reforms. On Nov. 2, 1789, the property of the church of France was confiscated; on Feb. 13, 1790, all monasteries and religious houses were suppressed; and on Dec. 26, 1790, the civil constitution of the clergy became law. All beneficed clergy were to be elected, and every beneficed priest was to take an oath to observe the new civil constitution. A schism was the immediate result. Mirabeau attempted to guide the Assembly in the direction of a limited monarchy such as existed in England. But on Nov. 7, 1789, the deputies rejected the proposal that ministers should sit in the Assembly, and the indecisive character of Louis XVI. destroyed all chances of the execution of any of Mirabeau's admirable schemes. He was at any rate able by his influence to prevent France from taking up the cause of Spain in a quarrel between that power and England over Nootka Sound. Shortly after Mirabeau's death the king attempted to fly from France. Captured at Varennes, he was brought back to Paris, and was more strictly guarded than ever.

Meanwhile the Assembly had completed the constitution, which became law in September, 1791. Local governments were established, and all officials were elected. A new and in many ways excellent system of justice was set up, and the old *parlements* were abolished. Before dissolving, the Assembly passed a self-denying ordinance prohibiting any member of the Constituent Assembly from becoming a member of the new Legislative Assembly, which met in October, 1791. Thus the solution of new and difficult problems was left to inexperienced men, who had to a great extent been elected under the influence of the Jacobin Club. In this Assembly the leading section was composed of Girondists, so called because they came from the Gironde, and of whom the leading representatives were Vergniaud, Gensonné, and Guadet; connected with them were Roland and Madame Roland, Brissot, Isnard, and others. These men were republicans and desired a war with Austria, in the hope that the French king's overthrow would ensue, and that a republic would be formed.

In addition to the question of the punishment of the clergy who refused to take the oath to

French Revolution

the civil constitution, there was the burning question of the *émigrés*. Large bodies of French nobles were at Worms and Koblenz, watching for an opportunity of returning and of overthrowing the Revolution. The Girondists demanded that the emperor Leopold should expel the *émigrés* from German territory, and on April 20 Louis XVI. declared war upon Austria. Defeats on the frontier led to the insurrection of June 20, 1792. Then another insurrection was organized by the Jacobins; and on Aug. 10, 1792, the king was deposed, a republic set up, and a national convention summoned. Further reverses on the frontier led to the September massacres, and to determined efforts to repel the invaders. On September 20 the Parisians were defeated at Valmy, and the French armies advanced across the frontier. The Rhine was reached, Savoy and Nice occupied, and by the battle of Jemappes (November 6) Belgium was conquered, and the Scheldt declared open to the commerce of the world. Europe now became thoroughly alarmed, and even Pitt recognized that war might ensue. Flushed by their victories, the arrogance of the French showed itself in the declarations of November 19 and December 15, in which they called upon all nations to rise against their rulers, and in their evident intention to invade Holland.

Meanwhile, on Jan. 21, 1793, the Jacobins, with the connivance of the Girondists, brought about the execution of Louis XVI., and on February 1 declared war upon England and Holland. Spain, Portugal, the Empire, Tuscany, and the Two Sicilies at once declared war upon France. The defeat of the French at Neerwinden on Mar. 21, 1793, and the flight of Dumouriez, the Girondist general, led to the overthrow of the Girondists. The situation was critical. A royalist rising had broken out in La Vendée, and many departments favored the Girondists. The Jacobins published the republican Constitution of 1793; to defend France they formed the Grand Committee of Public Safety (July 10). The rule of this committee is known as the Reign of Terror, and lasted for a year. An institution known as the Committee of General Security dealt with all police matters, while the revolutionary tribunal, founded in March, 1793, took cognizance of all political offences, and, as a rule, inflicted the penalty of death. Jacobin deputies were regularly sent on mission, and thus the provinces were brought into subordination to Paris. In the Grand Committee of Public Safety were to be found Carnot, Robespierre, St. Just, Couthon, Jean Bon St. André, Lindet, Prieur of the Côte d'Or, and Prieur of the Marne, and in September Billaud-Varenne and Collot d' Herbois were added.

The Capture of the Bastile, July 14, 1789.
(From an old print.)

The revolt in La Vendée was put down, and the allied troops were driven from the frontiers. The victories of Hondschoote (September 8) and of Wattignies (October 16), together with the recapture of Toulon (December 18), freed France of all fear of invasion.

Success was, however, at once followed by quarrels among the Jacobins. Robespierre looked with suspicion upon Hébert, who was popular with the mob in Paris, and he distrusted Danton, who was in favor of a relaxation of the system of terror. On March 14, 1794, the Hépertists were exe-

cuted, and on April 5 the Dantonists suffered the same fate. Robespierre was now supreme. Though the government failed at sea, the French fleet being defeated on June 1 by Lord Howe, on land the Austrians were disastrously defeated at Fleurus. The Reign of Terror becoming more and more oppressive, a conspiracy was hatched in the Convention itself, and on July 26, 1794 (9thThermidor), Robespierre was overthrown. This Thermidorian reaction lasted a little over a year, during which the party in favor of moderation gradually gained ground. The extreme Jacobins were in some cases executed and a party called the *jeunesse dorée* made itself conspicuous by attacking all who sympathized with the régime of terror. The Jacobin Club was closed, seventy-three Proscribed sympathizers with the Girondists were restored to their seats in the Convention, and early in 1795 several outlawed Girondists were allowed to return. The Jacobins were not, however, willing to yield without resistance, and on April 1, 1795, they made the insurrection of 12th Germinal, followed by one on May 20, known as that of 1st Prairial. Both of these risings were to some extent bread riots, caused by the misery in parts of Paris. As Louis XVI.'s brother, the Count of Provence, refused to recognize that the *ancien régime* was over, the government drew up a new constitution, known as that of the year III. The executive was placed in the hands of five directors, and the legislature consisted of two chambers—the Council of Ancients and the Council of Five Hundred. One-third of the two councils were to retire annually, and while the Council of Ancients was concerned with diplomatic questions, the Council of Five Hundred initiated fresh taxation. To the directors was allotted the control of the armies and the fleets, the direction of foreign policy, and the management of the internal administration. The government which drew up this constitution could boast that during the year 1795 French armies had conquered Holland, invaded Spain and Germany, had broken up the coalition, and had overthrown an attempt of the *émigrés* at Quiberon. None the less, on October 5 the insurrection of the 13th Vendémiaire broke out, and was only quelled by the assistance of the cannon of the young Bonaparte. The rising being suppressed, the Convention hastened to elect the first five directors, and France entered upon the period known as that of the Directory. This was merely the inevitable prelude to the consulate and the empire.

See Sybel's *Hist. of the French Revolution* (Eng. trans. 1867–9); Sorel's *Europe et la Révolution Française* (1885, etc.); Morse Stephens's *The French Revolution* (1886); Taine's *The Ancient Régime and the Revolution* (Eng. trans. 1876–85); Carlyle's *The French Revolution* (1837); and histories of the revolution by Mignet (1824), Michelet (1847–53), Louis Blanc (1847–63), and Quinet (1865); Tocqueville's *France before the Revolution* (Eng. trans. 1888).

French Spoliation Claims. Claims of U. S. citizens brought first and without avail by the U. S. Government against France, and subsequently brought by the aggrieved citizens and their heirs against the U. S. Government. By the treaty of Feb. 6, 1778, between France and the U. S., France agreed to assist the U. S. in their war against Great Britain, and the U. S., in turn, agreed to guarantee forever to France her possessions in the West Indies and to give to French vessels certain exclusive privileges in American ports. When war broke out between France and Great Britain in 1793, however, President Washington issued a proclamation of neutrality, and in 1794, by the Jay Treaty (q.v.), the U. S. granted to Great Britain certain privileges which amounted in effect to a breach of a provision of one of the French treaties of 1778. France, therefore, felt aggrieved against the U. S. In turn, however, especially during the 'quasi-war' between the two countries in 1798–99, France seized, in violation of international law, a number of American merchantmen. For these seizures the U. S. demanded indemnity, but finally, by the convention of 1800, the demand was dropped, and France, on her part, released the U. S. from the obligations imposed by the treaties of 1778. The owners of the seized vessels, or their representatives, then presented their claims to the U. S. Government, which for more than three-quarters of a century refused to recognize their validity. Bills for their payment were passed by Congress in 1846 and 1855, but were vetoed by Presidents Polk and Pierce respectively. Finally in 1885 an Act was passed, and signed, referring to the U. S. Court of Claims such claims to indemnity upon the French Government as arose 'out of illegal captures, detentions, seizures, condemnations, and confiscations' before 1801. The court was to pass on the claims presented, and to 'report to Congress, for final action, the facts found by it, and its conclusions.' By June 30, 1905, claims had been filed on 2,399 vessels; the amount found for claimants and certified to Congress was $5,375,409; and the amount appropriated by Congress was $3,950,452. Claims against France for depredations subsequent to 1801 were brought directly by the U. S. Government against France, and were allowed and paid, in whole or in part, under the provisions of the treaties of 1803, 1819 (with Spain), and 1831. By the last France agreed to pay 25,000,000 francs (the U. S. agreeing to pay for similar claims brought against her by France 1,500,000 francs), but the refusal of France for a time to adhere to this treaty brought the two countries almost to the verge of open rupture during President Jackson's administration, the payment finally being made in 1836. For a full account of the history of the original spoliation claims, see the opinion of the Court of Claims (rendered May 17, 1886) in the case of the schooner *Sally*; and see the volume of *French Spoliation Claims; Opinions of the Court* (n.d.).

Frenchtown, BATTLE OF, a battle of the War of 1812, fought Jan. 22, 1813, on the site of the present Monroe, Mich. (See MONROE.)

French West Africa. A number of French colonies in West Africa, administered under the authority of a governor-general, and comprising Senegal, together with nearly all of the Sahara, French Guinea, the Ivory Coast, Dahomey, and the Senegambia and Niger territories. The governor-general resides at Dakar, Senegal. See above titles.

Freneau, PHILIP (1752–1832), American poet, was born in New York city, of Huguenot descent, and graduated (1771) at Princeton, where, with H. H. Brackenridge, he delivered at commencement a poetical dialogue on 'The Rising Glory of America.' He made mercantile voyages to the West Indies in 1776 and 1780, was captured by the British during the second one, and described his experiences as a prisoner at New York in *The British Prison Ship: a Poem in Four Cantos* (1781). Other early publications are his *Voyage to Boston*, a poem (1774), and *General Gage's Confession* (1775). He was a frequent contributor of patriotic verse to the *Freeman's Journal* of Philadelphia during the Revolution. After its close he was principally occupied as a shipmaster in the West India trade until 1791, when he was made editor of the *National Gazette* of Philadelphia by Jefferson. This connection lasted for two years, and he then edited a paper at Mt. Pleasant, N. J., and engaged in other

journalistic work for a few years, subsequently returning to a seafaring life and following it until the restrictions on navigation made it unprofitable in 1809. He subsequently resided at his home in Mount Pleasant, N. J. Freneau was the first distinctive American poet, and his verse, though uneven, is characterized by grace, sentiment, and originality. His books include *The Poems of Philip Freneau, Written chiefly during the Late War* (1786), *Poems Written and Published during the American Revolutionary War* (1809), and *A Collection of Poems on American Affairs* (1815). A collective edition, *Poems, Edited for the Princeton Historical Association by F. L. Pattee* was published in 1902–3. See Mary Austin's *Philip Freneau: Life and Times* (1901), and V. H. Palsits's *Bibliography* (1903).

Frere, Sir Henry Bartle Edward (1815–84), English statesman, was born at Clydach, Brecknockshire, and entered the Indian civil service (1834). He was successively resident at Sattara (1846), chief commissioner in Sindh (1850–9), member of the viceroy's council (1859–62), and governor of Bombay (1862–7). His mastery of Indian vernaculars, and his intimate knowledge of native character, made him an authority on all questions of Indian administration. The system of revenue settlement which he instituted in Bombay was extended to Mysore and Berar. His firmness and grasp of the situation not only saved Sindh in the dark days of the Mutiny, but materially assisted in averting the disasters which threatened Central India and the Punjab. Proceeding, in 1872, as commissioner to the east coast of Africa, he secured from the sultan of Zanzibar a treaty for the abolition of slavery throughout his dominions. In 1877–81 he was governor of the Cape, and first high commissioner of S. Africa. The aim of his policy was S. African confederation, but the recalcitrancy of the Boers and troubles with the Zulus which led to war (1878–9) thwarted him in carrying it out. He was recalled in 1880, but his reputation for statesmanship has been enhanced by more recent history. See *Life* by Martineau (1895).

Frere, John Hookham (1769–1846), English author and diplomatist, was born in London. While sitting as member for West Looe in Cornwall (1796–1802), he published in conjunction with Canning, the *Anti-Jacobin, or Weekly Examiner* (1797–98), to which he contributed some of the wittiest *jeux d'esprit* in the collection. After serving in 1799–1800 as under-secretary of state, he was appointed envoy to Lisbon, and then to Madrid (1802–4, 1808–1809). The remainder of Frere's life was spent in retirement, chiefly at Malta, where he made his unrivalled translations of Aristophanes—*The Frogs* (1839), *The Acharnians*, *The Knights*, and *The Birds* (1840). His *Theognis Restitutus* (anon. 1842) appeared in Bohn's Classical Library. See *Memoir* by Sir Bartle Frere in *Collected Works* of J. H. Frere (1874); also Introduction to Frere's *Aristophanes* (1886), by Professor Morley.

Frère, Pierre Edouard (1819–86), French genre painter; born at Paris, entered the studio of Delaroche. His first exhibits appeared in the Salon of 1843, and he soon acquired a wide reputation for delicate and sympathetic rendering of scenes from humble life. His studies of child-life have especial charm, showing close observation, combined with *naïveté* and simplicity. All his works show great care and accuracy in execution. Among his pictures are: *The Hen with the Golden Eggs*, *Rest*, *The Student*, *Prayer*, and *The Gleaner Boy*. Three of his pictures are in a private collection in Baltimore, and his *Exercise* is in New York in the collection of J. J. Astor.

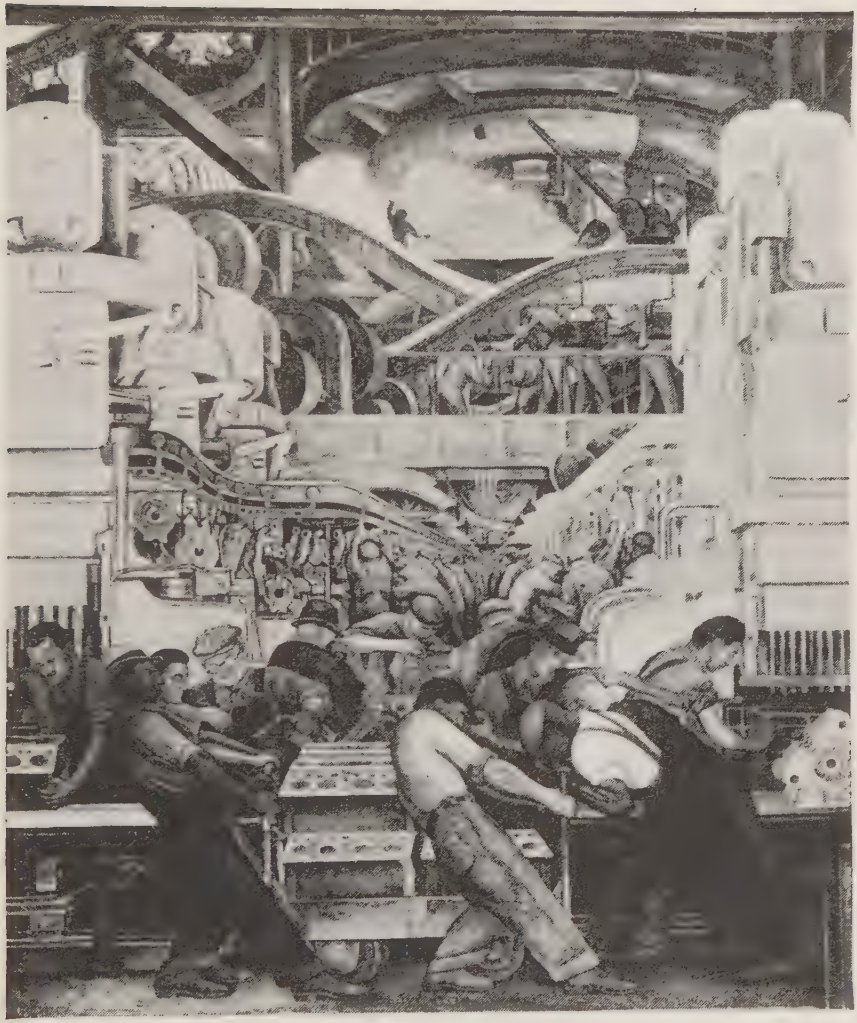
Frère-Orban, Hubert Joseph Walther (1812–96), Belgian statesmen, born at Liège. Elected Liberal member for Liège in the Belgian Parliament, he became minister of public works, and in 1848, as minister of finance, successfully tided over the financial crisis by the foundation of the Belgian National Bank. His work, *La Main-morte et la Charité*, appeared in 1854. Once more appointed minister of finance (1857), he remained in office with one short interval until 1870; entrusted in 1878 with the formation of a new cabinet, he endeavored to combat the Clerical party by a new scheme of education (1879). The disaffection of the Radicals, however, led to the fall of the ministry in 1884. M. Frère-Orban was the Gladstone of Belgium. He wrote several works of great value, the most important of which were *La Question Monétaire* (1874) and *La Question Monétaire en Belgique* (1889).

Frere Town, or Kisauni, on the coast of British E. Africa, 2 m. N.N.E. of Mombasa; headquarters of the Church Missionary Society in British E. Africa. Pop. 2,000.

Fréron, Elie Cathérine (1719–76), French critic, born at Quimper; at twenty became professor in the Collège de Louis-le-Grand at Paris. He founded the journal *Lettres de la Comtesse de . . .* (1746), and on its suppression (1749), *Lettres sur quelques Ecrits de ce Temps*, which, in 1754, became *L'Année Littéraire*. In these periodicals Fréron, as the champion of church and throne, attacked Voltaire and the Encyclopédistes, provoking from the former a reply in the satirical drama *L'Ecossaise*, which has perpetuated the name of Fréron more successfully than have his own writings. See *Les Confessions de Fréron*, by Barthélemy (1876); *Les Ennemis de Voltaire*, by Ch. Nisard (1833).

Fresco. The art of painting, or the work of art produced by painting, with a water-color medium upon either freshly laid or damped plaster is known as 'fresco.' The latter method, usually spoken of as *fresco secco*, is understood to be the more ancient, and to have been that employed in the decoration of Etruscan tombs, and in Egypt; but true fresco, the *buon fresco* of the Italians, is also of great antiquity, having been used in Rome and Pompeii. Secco, however, has outlasted fresco in actual practice, being still extensively used for the rougher kinds of decorative work, while fresco is now seldom used, and then only in experimental form. In secco the plaster ground, being already existent, or having been prepared and allowed to dry thoroughly, is well damped before the artist begins his work, and forms a partially absorbent ground for the colors when applied, and wall and decoration dry together. But the great decorations of the 14th, 15th, and 16th centuries were executed in fresco —*i.e.* upon freshly laid plaster. The palette available is a restricted one; for the colors, having to stand the action of the lime in the plaster, the union of which with the pigments forms carbonate of lime, are principally those obtained from natural earths. Before beginning to paint, however, the artist usually prepares a colored sketch and a full-sized cartoon of each subject. Fresh plaster sufficient for a day's work is laid upon the wall, and then with a blunt iron stylus the outlines of the cartoon, held against the plaster, are traced, leaving indented lines on the surface beneath. The artist then proceeds with the actual painting, working with great rapidity and precision; for everything that can be expressed in one painting has to be done, and the work carried as far as possible. For retouching will never equal the original work in softness, spontaneity, and style; while, having to be done in *tempera*, it will not be nearly so permanent as the fresco itself.

The famous mural decorations



Courtesy Detroit Institute of Arts

PART OF THE RIVERA FRESCO ON NORTH WALL, DETROIT INSTITUTE OF ARTS, TYPIFYING THE AUTOMOTIVE INDUSTRY

of the earlier Italian schools were executed in fresco. Typical of the achievements of the great masters of this medium are the frescoes in the Campo Santo (Pisa) by Gozzoli of Florence; the Arena chapel (Padua) by Giotto; the church of S. Maria Novella (Florence), by Ghirlandaio; the convent of Saint Mark (Florence), by Fra Angelica; the Riccardi chapel (Florence), by Gozzoli; the Siena library, by Pinturicchio and his pupils; the stanze of the Vatican, by Raphael; the Sistine chapel by Michelangelo; and the Parma cathedral by Coreggio.

After the introduction of an oil medium by the Van Eycks, early in the 15th century, fresco was gradually displaced. During the 19th century an attempt was made by a group of German painters, known as 'Nazarenes' (Overbeck, Cornelius, and others), to reintroduce fresco decoration on a large scale; but their efforts were not crowned with perfect success. In Britain a similar attempt was made about 1845, in connection with the decorations of the new Houses of Parliament. The best result of this is to be seen in Dyce's frescoes in the royal robing room at Westminster. In recent years some notable frescoes have been executed by an American artist, Gardner Hale.

Consult Merrifield's *The Art of Fresco Painting as Practised by the Old Italian and Spanish Masters;* Ward's *Fresco Painting, Its Art and Technique.*

Frescobaldi, fres-kō-bäl'dē, GIROLAMO (1583–1644), Italian musical composer and organist, was born in Ferrara. He early gained a reputation as a singer, and later as an organist, and in 1614 was appointed organist at St. Peter's, Rome. This position he held, with a short interval of absence in Florence, until his death. His compositions, which are numerous, include both instrumental and vocal pieces; among them a collection of five-part madrigals, *Ricercari et canzoni francesi, Capricci sopra diversi soggetti* and *Arie musicali a più voci.*

Frese, frā'ze, JAKOB (1691–1729), Swedish poet, was born in Viborg, in Finland, and became a clerk in the Swedish chancery at Stockholm. He was a man of genuine poetic talent and is seen at his best in his beautiful hymns and his exquisite poems on the 'Spring.' His *Samlade Dikter* appeared in 1876.

Fresh Air Work, a philanthropic movement to give the children of the slums and tenements of great cities a short period of recreation in the country or at the seashore. It is said to have been inaugurated by Rev. W. A. Muhlenburg, rector of the Church of the Holy Communion, New York City, as early as 1849, and is at present carried on in cities throughout the United States, as well as in Europe and some few South American countries. In the United States it is conducted by general agencies supported by private funds, by church organizations, and by private institutions, and outings are provided each summer for millions of poor children.

Fresh'field, DOUGLAS WILLIAM (1845–1934), English explorer and author, was born in London, and was educated at Eton and Oxford. He was the first to climb Kazbek in the Caucasus, and to attain the eastern summit of Elbruz, and about 1899 made a remarkable journey round Kangchenjunga at a high level. He visited Uganda and the snows of Ruwenzori in 1905, the Japanese Alps in 1913, and the American Rockies in 1921, and wandered far beyond beaten tracks in Syria, Armenia, Bosnia, Corsica, Algeria, and in the Apennines and Alpine regions. He acted as honorary secretary of the Royal Geographic Society from 1880 to 1894, and as president from 1914 to 1917. He published a valuable map of the Caucasus, and a number of works based on his explorations, including *Travels in the Central Caucasus and Bashun* (1869), *Italian Alps* (1875), *Exploration of the Caucasus* (1896), *Round Kangchenjunga* (1903), *Hannibal Once More* (1914), *Unto the Hills* (1914), *The Life of De Saussure* (1920), and *Below the Snowline* (1923).

Fresnel, frā-nel', AUGUSTIN JEAN (1788–1827), French physicist, was born in Broglie (Eure). He was an engineer of the Ecole des Ponts et Chaussées, lost his post on Napoleon's escape from Elba, but was subsequently reinstated, and became secretary of the lighthouse department. His discoveries established the undulatory theory of light, first advanced by Young. He invented the Fresnel lenses for lighthouses, and introduced revolving lights.

Fresnillo, fres-nēl'yō, town, Mexico, State of Zacatecas, at the base of Cerro del Proaño; 35 miles northwest of Zacatecas. It has important silver and copper mines and produces wheat, fruit, and timber. Pop. 7,000.

Fresno, fres'nō, city, California, county seat of Fresno county, in the valley of the San Joaquin River, and on the Atchison, Topeka and Santa Fe, and the Southern Pacific Railroads; 160 miles southeast of San Francisco. It has a Carnegie public library, six parks and a drive (Kearney Drive), 11 miles in length, lined with palms, eucalyptus and oleander. Grapes for raisin-making, figs, and peaches are grown, and there are fruit-packing, dairying, and live-stock interests. The surrounding district contains oil and copper. Fresno is an important shipping point, especially for lumber and fruits, and is the centre for the distribution of electric power to surrounding towns. According to the Federal Census of Manufactures for 1937 its industrial establishments numbered 150, with 3,883 wage earners, and products valued at $35,462,143. Pop. (1910) 24,892; (1920) 45,086; (1930) 52,513.

Fret, or FRETTE, in heraldry, a narrow saltire interlaced with a mascle at the center of the shield. *Fretty* is formed by a number of strips in bend interlaced with an equal number in bend sinister, forming a sort of trellis over the whole shield.

Freud, froit, SIGMUND (1856–1939), Austrian psychoanalyst, was born in Freiburg. He was graduated in medicine at the University of Vienna and became assistant physician and lecturer on nervous diseases at the Vienna General Hospital, later going to Paris, where he studied under Charcot. In 1902 he became professor of neurology in the University of Vienna. He is particularly known on account of his analysis and treatment of hysteria and his theory of dreams. (See DREAMS.) Freud advanced the theory that all abnormal mental states have their bases in submerged repressions which have been lost by the conscious layer of awareness and retained by the unconscious. Investigation and analysis of the patterns of experience lead to an understanding and appreciation of the cause of mental disorders, and thence to eventual cure.

He edited the *International Zeitschrift fur ärtzliche Psychoanalyse, Imago,* and *Schriften zur angewandten Seelenkunde.* His publications include *Zur Auffasung der Aphasie* (1891); *Studien ueber Hysterie* (1895, Eng. trans. 1913); *Traumdeutung* (1900, Eng. trans. 1913); *Der Witz und seine Beziehung zum Unbewussten* (Eng. trans. 1916); *Zweite Folge* (1909); *Totem und Tabau* (Eng. trans. 1918); *A General Introduction to Psychoanalysis* (trans. by G. S. Hall, 1921); *Group Psychology and the Analysis of the Ego* (1922).

Freund, froint, WILHELM (1806–94), German philologist, was born in Kempen (Posen) of Jewish parentage. After teaching in Breslau (1828), in Hirschberg (1848–51), and in Gleiwitz (1855–70), he settled at Breslau, to devote himself to literary work. His chief work, the *Wörterbuch der lateinischen Sprache* (1834–45), is a standard lexicon. It was followed by two other Latin dictionaries, an edition of

Cicero's *Pro Milone* (1838), and a series of school books. His *Wie studiert man Philologie?* (6th ed. 1903), *Triennium philologicum* (2d ed. 1879–85), and *Wanderungen auf klassischen Boden* (1889–90) are also noteworthy.

Frey. See FREYR.

Frey, frī, JOSEPH SAMUEL CHRISTIAN FREDERICK (1773–1850), German-American clergyman, was born in Mainstockheim, Bavaria, and became a reader in the synagogue. Later he embraced Christianity, and was baptized in 1798 as a Protestant. He engaged in missionary work in England for several years, and in 1816 went to the United States, being ordained pastor of the Mulberry street Congregationalist church at New York in 1818. His efforts to found an organization for the benefit of Christian Hebrews were unsuccessful, and he joined the Baptist Church in 1827 and held several pastorates. Ten years later he was appointed an agent of the American society for the conversion of the Jews, and visited Europe in connection with its work. He met with little success, however, and later accepted a position as instructor in Hebrew in Michigan State University. He published *Narrative of My Life* (1809) and several controversial works.

Freycinet, frā-sē-nā', CHARLES LOUIS DE SAULCES DE (1828–1923), French statesman and engineer, was born in Foix (Ariège), was educated in Paris, and for several years held important government appointments. After the fall of the empire he was appointed head of the military department at Tours, and in 1871 published a record of his administration *La Guerre en Province pendant le Siège de Paris*. He entered the Senate in 1876, and identifying himself with the Republican party, was appointed (1877) to the ministry of public works, in which capacity he did much to develop the railway and canal systems of France. He was four times premier (1879, 1882, 1886, 1890), and four times minister for war (1888, 1889, 1892–93, 1898). He published *La Philosophie des Sciences* (1896), *La Question d'Egypte* (1905); *Mémoires* (1914). He was elected to the French Academy in 1891.

Freycinet, LOUIS CLAUDE DE SAULSES DE (1779–1842), French navigator, was born in Montélimart. He entered the navy in 1793, sailed in 1800 with the expedition under Captain Baudin to explore the southern coasts of Australia and Tasmania, and on his return was employed by the government to prepare maps of the territory explored. In 1817 he sailed for South America and cruised about there and in other parts of the Pacific for three years. With the collaboration of Arago, Gaudichaud, Pellion, and others, Freycinet embodied the results of the cruise in the *Voyage autour du Monde* (1824–44). He also completed Péron's account of Baudin's expedition.

Freycinetia, frī-si-nē'shi-*a*, a genus of evergreen tropical climbing plants of the family Pandanaceæ, native to the Indian Archipelago. They are sometimes cultivated in greenhouses but require so much room that they are better used as pillar plants. *F. banksii* is the most beautiful species.

Freyja, frī'yä, the Norse goddess of the spring, love, and fertility, sister to the god Freyr (q. v.). She was often confounded, and in later times identified, with the goddess-mother Frigga, the wife of Odin.

Freyr, frīr, or FREY, the Norse god of rain, fertility, and peace, was, like his sister Freyja and his father Njord, a survival from the pre-Odinic mythology. His festival was at the winter solstice (Christmas). A well known saga relates his wooing of Gerda, daughter of the frost-giant Gymir.

Freytag, frī'täk, GEORG WILHELM FRIEDRICH (1788–1861), German orientalist, was born in Lüneburg. After serving as a chaplain with the Prussian army, he settled (1815) in Paris to study Arabic, Persian, and Turkish with De Sacy. From 1819 until his death he held the professorship of Oriental languages at Bonn. His chief work is a valuable *Lexicon Arabico-Latinum* (1830–7).

Freytag, GUSTAV (1816–95), German novelist and dramatist, was born in Kreuzburg, Silesia. He was for a time lecturer in German language and literature at Breslau and then with Julian Schmidt edited the Liberal Newspaper *Die Grenzboten* at Leipzig (1848–61 and 1867–70). From 1867 to 1870 he was a member of the North German Reichstag, and for a time during the French War was attached to the staff of the Crown Prince.

Freytag's fame rests principally upon his dramas and novels. The comedy *Die Journalisten* (1845), of which an excellent English edition (1900) has been prepared by H. W. Eve, is generally recognized as the best German comedy of the 19th century. In 1859 the tragedy, *Die Fabier*, was published and in 1863 *Die Technik des Dramas* (Eng. trans., 1894), notable for its critical insight. Freytag's first novel of modern life, *Soll und Haben*, appeared in 1855 (60th ed. 1904), and immediately attracted great attention (Eng. trans. *Debit and Credit*, 1858). It was followed by a series of popular historical essays, *Bilder aus der deutschen Vergangenheit* (1859–67), and by another novel, *Die verlorene Handschrift* (1864; 36th ed. 1902; Eng. trans. 1865). The eight years (1872–1880) following the author's brief political career, were given to the cycle of seven novels entitled *Die Ahnen* (*Our Ancestors*) (1872–80), covering the period from the *Völkerwanderungen* to the first half of the 19th century.

Freytag was a man of noble character, with a gift of humor rare among novelists of his generation. His collected works, in twenty-two volumes, were issued between 1886 and 1888. For his life, see his own *Erinnerungen aus meinem Leben* (1887; Eng. trans. 1890), and Seiler's *G. Freytag*.

Friar, frī'*er*, a corruption of the French *frère*, is the popular distinguishing title of the members of the mendicant orders. The first friars were the Franciscans or Grey Friars and Dominicans or Black Friars. To these were added the Carmelites or White Friars by Innocent IV. (1224), and the Augustinian hermits or Austin Friars by Alexander IV. (1256). In the 15th century the Servites and Trinitarians or Crutched Friars were granted the same privileges as the four mendicant orders.

Friar's Balsam, popular name for the compound tincture of bezoin, prepared by dissolving benzoin, storax, tolu balsam, and aloes in strong alcohol. See BENZOIN.

Fribourg, frē-bōōr', or FREIBOURG, a canton in the western part of Switzerland, with an area of 644 square miles. The southern and eastern parts are elevated, and the northwestern part lies in the basin of Lake Neuchâtel. It is watered by the Saane and the Broye. The forests furnish good timber, and coal occurs in small amounts. Farming and dairying are the chief industries; cattle are exported, and the canton is especially famous for its cheese. Tanning and straw-plaiting are carried on, and watches, leather goods, paper, and cigars are manufactured. Pop. (1930) 143,230.

Fribourg, city, Switzerland, capital of the canton of the same name, on the Saane River; 20 miles southwest of Bern. The river is here crossed by two great suspension bridges constructed in 1832 and 1840 respectively. Interesting features are the Town Hall, the Church of St. Nicholas begun in 1283, and containing a fine organ, the Ursuline convent, and the University (R. C.). The inhabitants are chiefly French-speaking. Pop. (1930) 21,557.

Frick, HENRY CLAY (1849–1919), American manufacturer and capitalist, was born in West Overton, Pa. He began business as a

flour merchant and distiller, and afterwards took up the manufacture of coke. In 1892 his vigorous resistance to, and control of, the Homestead strike, brought him into public notice and resulted in an attempt to assassinate him by an anarchist, who was arrested and sentenced to sixteen years' imprisonment. In 1897 Mr. Frick was elected president of the H. C. Frick Coke Company. He was connected with the Carnegie Steel Co. and many other large business enterprises.

Friction. When two bodies rub on each other, there is a force where the rubbing occurs called friction which resists motion. The laws of friction were first investigated by Coulomb in 1781 and Morin in 1831–3, and since then have been studied by many experimentalists.

The ordinary laws of solid friction, true as far as they go, are stated thus: The friction between

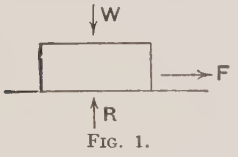


Fig. 1.

the two surfaces of a sliding pair is equal to the total perpendicular pressure between the surfaces multiplied by the coefficient of friction. If W (Fig.1) be the weight on the plane horizontal surface, the reaction is $R = W$ by the third law of motion. Then the frictional force is $F = \mu R$, the direction of the force being opposite to that in which motion is about to take place. The coefficient μ depends on the material and condition of the rubbing surfaces, but is independent of the velocity and the extent of the surfaces in contact. Much of the mathematical theory of the subject is founded upon this. F may be measured by the weight suspended in a scale pan necessary to cause sliding (Fig. 2). By taking different values of W and F,

Fig. 2.

and plotting (see Graphical Methods) the results on squared paper, μ may be found. If the plane be tilted through an angle ϕ (Fig. 3), so that sliding just takes place, then by the triangle of forces $\mu = \tan \phi$, and this also gives μ. The value of μ when sliding is just about to commence is greater than when sliding is taking place; the former is sometimes called the coefficient of limiting or statical friction, and

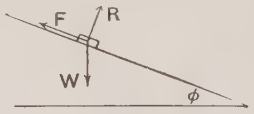


Fig. 3.

the latter that of kinetic friction. The laws of fluid friction are very different from these:

Comparison of the Laws of Solid and Fluid Friction (Perry).

Solid.	*Fluid.*
1. The force of friction is not much affected by the velocity, but is greatest at low speeds.	1. The force of friction depends on the velocity, and is very small when speed is very low.
2. The force of friction is proportional to the total pressure between the two surfaces.	2. The force of friction is independent of the pressure.
3. The force of friction is independent of the areas of the surfaces in contact.	3. The force of friction is proportional to the area of the wetted surface.
4. The force of friction depends to a great extent on the nature of the surfaces in contact.	4. The force of friction is not greatly affected by the nature of the surfaces when the speeds are moderate.

Owing to this great difference, which shows the value of lubrication, it has been overlooked that all so-called solid friction is probably fluid friction taking place in the fluid (air or lubricant) which separates the surfaces. Professor O. Reynolds suggests that we must to some extent look to hydro-dynamics to explain the curious phenomena of solid friction. Flat plates unloaded have little friction, owing to the thick air film between them; load them heavily, and the air film is made thin, and sticking occurs, due probably partly to vacuum and partly to molecular attraction.

To minimize the effect of friction lubricants are used. Journals and other bearings *slightly* lubricated, as with an oily pad, follow the laws of solid friction approximately. Pressure in the lubricant is very great where the journal most nearly approaches the step; so when running in one direction with very slight lubrication the lubricant gets squeezed out and carried from the place where it is most wanted, and the journal may seize at a comparatively low pressure. If, however, there be reversal or irregularity of motion, the lubricant keeps its place better, and higher pressures may be used, as in railway axles. With very good lubrication, as with an oil bath, the lubricant is constantly carried to where it is required, and heavy loads may be sustained without seizing, the laws of fluid friction being approximately followed.

The number of foot-pounds of work wasted or degraded into heat is the product of the frictional force in pounds and the distance through which rubbing occurs in feet. To minimize this in a journal, it should have the smallest diameter consistent with strength. In the flow of a fluid along a pipe the frictional loss of energy per pound is clv^2/m, where m is the hydraulic mean depth, or sectional area divided by wetted perimeter, l is the length, v the velocity, and c a frictional coefficient. (See Hydraulic Machinery.) The energy lost in a belt is partly due to slip, and partly to bending and unbending. In all cases the energy spent in overcoming friction is dissipated or rather degraded into heat.

When one body rolls upon another there is a frictional loss of energy; but there is little experimental knowledge on this subject. The loss is probably due to the strain in and viscosity of the material, and also to slipping at the surfaces in contact. The latter may be studied by considering the wave in front of a heavy wheel rolling on an india-rubber surface. When the loads are not too heavy, there is a great saving by substituting rolling for sliding friction, as in ball bearings for bicycles, the roller bearings for shafting, and the friction wheels in delicate instruments like Attwood's machine.

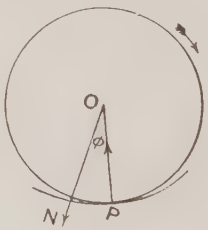


Fig 4.

Let the direction in which a journal revolves be indicated by the arrow (Fig 4); then it may be shown by the triangle of forces that the journal rides up in the step through the angle $NOP = \phi$ = angle of friction, so that $\tan \phi = \mu$, whence its value may be determined.

When a rope (Fig. 5) is passed round a rough cylindric bitt (co-

efficient of friction μ, and embracing an angle θ radians), the tensions P and Q are given by the equation $Q = Pe^{\mu\theta}$. (See DYNAMICS.) This shows that as the arc of contact is increased arithmetically Q is increased geometrically, and explains how a small pull at one end of a rope may balance a great force at the other end owing to the frictional forces called into play.

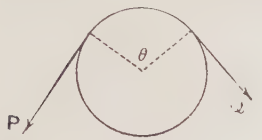


FIG. 5.

Tables of values of coefficients of friction are to be found in such books as Molesworth's *Pocket-Book of Engineering Formulæ;* Trautwine's *Engineer's Pocket-Book.* For further information, consult Tait and Thomson's *Natural Philosophy;* Professor Perry's *Mechanics;* also 'The Cantor Lectures on Friction,' by Professor Hele-Shaw, *Journal* (London) *Soc. Arts,* 1886, vol. xxxiii.

Friction Rollers, cylindrical or conical rollers usually of hard steel, placed under a body so that it may roll instead of slide, rolling being easier than sliding in most cases. Friction wheels are used similarly, in which case a journal may be supported on friction wheels, as in Attwood's machine, instead of running in ordinary bearings; this is much more efficient. Bearings are sometimes made so that the journal, instead of working in brasses, or in babbitt metal, is surrounded by and runs on friction rollers. They are said to effect a great saving of power in lines of shafting in mills. Ball bearings in bicycles and automobiles are of a similar nature.

Frictional Machines. See ELECTROSTATIC MACHINES.

Friday, the sixth day of the week. Among Germanic peoples it was sacred to the goddess-mother Frigga, wife of Odin. Friday having been the day of the Crucifixion. is kept as a day of abstinence in the Roman Catholic Church, Good Friday or Long Friday being the day of the annual commemoration of that event. Its association with the Crucifixion may explain the common superstition that Friday is an unlucky day. Friday being also the day of Adam's creation, is kept by Mohammedans as their weekly day of prayer.

Friedek, tn., Austrian Silesia, 14 m. S.W. of Teschen, has manufactures of linens, iron, and steel. There are mineral baths, and an old parish church, to which pilgrimages are made. Pop. 9,023.

Friedland. (1.) Old historic tn. of Bohemia, at the N. foot of the Isergebirge, 16 m. by rail N. of Reichenberg, with textile manufactures and lignite-mining. It is commanded by a castle, containing memorials of Wallenstein, who, in 1623, was created Duke of Friedland. Pop. 6,229. (2.) Town, E. Prussia, 26 m. S.E. of Königsberg, scene of the defeat of the Russians and Prussians by Napoleon on June 14, 1807. Pop. 2,824. (3.) Town, Mecklenberg-Strelitz, Germany, 43 m. N.W. of Stettin. Pop. 7,175.

Friedland, VALENTIN (1490–1556), German pedagogue, usually known as Trotzendorf, from his birthplace in Upper Lusatia. At Goldberg in Silesia he organized a school (1531), which before his death attained a European reputation. Organized on the principle of the Roman republic, with Friedland as master for life, the maintenance of discipline was largely in the boys' own hands. Latin was the sole language employed. See *Lives* by Pinzger (1825), Löschke (1856), and Sturm (1889).

Friedrich, JOHANNES (1836), German theologian, was born at Poxdorf in Upper Franconia. He was appointed professor of theology at Munich in 1865, and in 1882 was transferred to the philosophical faculty. He attended the Vatican Council in 1870, and in conjunction with Dr. Döllinger, headed the protest against the infallibility of the Pope. At a congress at Cologne in 1872, Friedrich declared the protesting party (called the Old Catholics) to be combating the whole papal system. See *Geschichte des Vatikanischen Konzils* (1877–83) and *Das Papsttum.*

Friedrichshagen, tn., Prussia, prov. Brandenburg, stands on the Spree, 9 m. by rail S.E. of Berlin. Pop. 11,288.

Friedrichsruhe, vil., Prussia, in the prov. of Schleswig-Holstein, 16 m. by rail E. of Hamburg. In the castle Prince Bismarck died in 1898.

Friedrichsthal, large vil., Prussia, prov. Rhineland. 7 m. by rail N.E. of Saarbrücken, with iron and coal mines and glass factories. Pop. 10,109.

Friedrich - Wilhelmshafen, harbor, Astrolabe Bay, on N.E. coast of Kaiser Wilhelms Land, New Guinea. It is the commercial capital of the colony.

Friendly Islands. See TONGA ISLANDS.

Friendly Societies. See FRATERNAL BENEFICIARY ORDERS.

Friends, SOCIETY OF. The rise of the Society of Friends was the result of the preaching of George Fox (1624–90). He taught that there was a direct divine revelation or 'inward light' given to every man, and that religion, therefore, was primarily a matter of individual conviction and experience. From this fundamental principle arose most of the distinctive views and practices of Fox and his followers. They insisted on the need of spiritual insight for the right understanding and use of the Scriptures. They held that the sacraments of baptism and the Lord's Supper were not essential; that there was no need of a ritual or of an ordained ministry; that women as well as men should be free to exercise the gift of preaching; and that silence was the fittest basis of public worship. They held also that war was incompatible with the spirit of Christianity, and refused to take oaths on the ground that all swearing was forbidden by Christ. They laid stress on the need of upright conduct and simplicity of life, and the application of the principles of religion to practical affairs.

Fox and his followers at first called themselves 'Children of the Light.' They soon, however, adopted the name of 'Friends,' and were also commonly known as 'Quakers.' Their numbers increased rapidly, and it is estimated that in 1680 there were at least 40,000 members of the society in England and Wales. Although Fox had originally no intention of founding a sect, he recognized the necessity of organizing the body which his preaching had brought into being. He therefore established a system of church government which, with certain additions, has continued to the present day. About the year 1666 the society was joined by Robert Barclay, and in 1668 by William Penn; and in their writings the distinctive views of the Friends found expression in a scholarly form.

The missionary zeal of the early Friends took them to many countries; and Fox himself travelled in the American colonies, the W. Indies, and Germany and Holland. In 1681 William Penn obtained from Charles II. a grant of the colony of Pennsylvania, in which he proposed to show that Quaker principles could be applied to political affairs. In the following year he sailed with his unarmed colonists, and signed his famous treaty with the Indians. This treaty was faithfully kept, and it is stated that no Quaker was ever killed by an Indian in Pennsylvania.

The views of the Friends

brought them into collision with both Episcopalians and Puritans, and the prolonged controversies were often violent. Until the end of James II.'s reign they were the victims of continual persecution. Many of them were imprisoned for preaching in streets and markets, for not paying tithes, for testifying against 'hat-worship,' and for refusing to take oaths. After the restoration they suffered under the Conventicle Act and under a statute passed in 1662 to enforce the taking of oaths, and their refusal to take the oath of allegiance subjected them to the heavy penalties of *præmunire*. It is estimated that by 1697, 16,735 Friends had been imprisoned and 152 transported, and that 370 had died in confinement or in consequence of their sufferings. James II.'s Declaration of Indulgence at length brought them a respite, and the era of persecution closes with the passing of the Toleration Act in 1689 and of a statute enabling them to affirm instead of taking oaths in 1696. They still, however, remained, with other dissenters, under many disabilities, and were for long liable to imprisonment for non-payment of tithes.

The 18th century was a time of ease and outward prosperity in the history of the Society. Debarred from political life by their unwillingness to compromise their religious testimonies and by their principles from the military profession, the Friends mainly devoted themselves to commercial occupations and to philanthropic objects. They tended, however, to become exclusive, and declined in numbers. Nevertheless, the period was not without its brighter features. John Woolman, an American Friend of singularly beautiful character, labored for the liberation of the slaves, and the Friends, roused by his efforts, warmly supported the movement. By 1780 the society had freed itself from the reproach of slave-owning, and in 1783 it sent up the first petition to the House of Commons for the abolition of slavery. In the long struggle for emancipation that followed the Friends took a prominent part. They also supported many other philanthropic movements—such as the promotion of unsectarian religious education, the reform of prisons and lunatic asylums, and the mitigation of the penal code; and their devotion to objects of this kind is still one of their marked characteristics.

The first half of the 19th century witnessed a development of more 'evangelical' tendencies among the Friends. The missionary spirit revived; Sunday schools were opened; and in 1866 the Friends' Foreign Mission Association (London) was established, which at the present time supports missionaries in India, Madagascar, Syria, China, and Ceylon. The American Friends' Board of Foreign Missions was established in 1882, and supports missionaries in Mexico, the West Indies, and British East Africa. Philadelphia Friends (Arch Street) with individuals in other groups have supported missionary work in Japan since 1883. Political and social changes, such as the removal of political disabilities and the throwing open of the universities to dissenters, have also influenced the character of the society. Friends began to take a more active part in public affairs; greater interest was shown in literature and art; the old exclusiveness disappeared; and peculiarities of dress and speech have been practically abandoned.

The Society has no creed, but the theological views expressed in its official documents do not differ materially from those embodied in the Apostles' Creed. It contains, however, two distinct (though mutually tolerant) schools of thought, which may perhaps be best described as 'mystic' and 'evangelical.' The former aims at maintaining intact the principles of Quakerism with regard to the spiritual character of religion; the latter is especially concerned with mission work, and has less sympathy with 'broad' modes of thought in regard to Biblical criticism and questions of theology.

A devotional silence forms the basis of the Friends' Meetings for worship. Emphasis is laid upon the priesthood of old believers. Therefore, any member is free to participate in the Meeting. Frontier conditions have greatly affected the Friends who settled in the central and western parts of the United States, and in some places more or less formal Meetings for worship under a leader have developed. Individual responsibility, however, is stressed by all Friends.

There are no paid or specially trained ministers, but Friends whose addresses are felt to be edifying are 'recorded' as ministers, as a recognition of their gifts. From the beginning of the Society, 'Elders' were appointed to give due consideration to the ministry in the Meeting, and 'Overseers' were appointed to have general oversight over the conduct of the members.

The separate congregations or 'particular meetings' are grouped into superior meetings known as 'monthly meetings,' which admit members, appoint officers, care for the poor, and act generally as the executive of the Society. The 'monthly meetings' in turn are grouped into 'quarterly meetings' and the 'quarterly meetings' constitute the Yearly Meeting, which is the body of final authority. Members of the Society may attend any of these meetings, but each subordinate meeting sends representatives to its superior meeting. The business is conducted without formal resolutions or voting, the 'sense of the meeting' being ascertained and recorded by its clerk. The business of the Yearly Meeting between its sessions is carried on by a standing committee known as the 'meeting for sufferings' (London); usually termed 'permanent board' in the United States.

In recent years in Great Britain the Friends have been actively engaged in carrying on 'adult schools' for men and women. These schools are conducted on unsectarian and often on democratic lines, and are well attended, their membership at the present time being about 100,000. In these schools there is generally little attempt to proselytize, and the members do not, as a rule, join the society. The membership of Friends Sunday schools for children is about 23,000.

The Friends have been more successful in influencing those outside their society than in adding to their own numbers. The present membership of the society in Great Britain, which is slowly increasing, is about 24,000 (including members residing abroad and in Ireland).

In the United States. The period of severe persecution referred to above was the occasion of the founding of the society in the United States. Some Friends emigrated to Boston in 1656, and encountering persecution there, were scattered. Others settled in New Jersey and Pennsylvania subsequent to 1674. Organization was early effected, the first Yearly Meeting being held in 1661, in Rhode Island, and till 1878 it was regularly held in Newport.

There are twenty-eight Yearly Meetings of Friends in the United States. Twelve of them are grouped together under the name of The Five Years Meeting of Friends. Seven are known as the General Conference, and the remainder are more familiarly known as Conservative Orthodox.

1. The Five Years Meeting, representing the largest body of Friends in the United States, are essentially evangelical in their belief and are associated with other evangelical churches. Once in five years they send official delegates to a Conference to consider questions of mutual inter-

est. They support eight colleges and four secondary schools. They number about 85,000.

2. The General Conference is made up of those Yearly Meetings formerly known as Hicksites, so named because of a split that occurred in the Society under the leadership of Elias Hicks (1784–1830), a noted minister of New York Yearly Meeting of Friends. The separation which took place in 1827 in Philadelphia, originated in an attempt by the Elders of Philadelphia to discipline Hicks, who was preaching in Pennsylvania, for alleged unsoundness of doctrine. This brought to light a fundamental difference in the Society of Friends. The orthodox section claimed that the basis of membership was doctrinal, and that the elders had the right to pronounce as to doctrinal soundness. The opposite party asserted that the church depended on immediate revelation of truth to the individual, and that neither elders nor any other body had the right to formulate a creed for others. A large majority of the Yearly Meeting sided with Elias Hicks. It supports one college and many good schools. The General Conference has a membership of 16,880.

3. The Conservative Orthodox. This group is not organized, but are more or less united in opposition to the modern methods of evangelistic work, and in maintaining testimonies in favor of meetings for worship on the basis of silence. Some of them still continue to wear the Quaker dress although the young people are breaking away from the custom. This group numbers about 7,000.

Consult Braithwaite's *The Beginnings of Quakerism* and *The Second Period of Quakerism;* Rufus M. Jones' *The Quakers in the American Colonies* and *The Later Periods of Quakerism;* Sharpless' *The Holy Experiment, The Journal of John Woolman, The Journal,* and the *Epistles of George Fox;* Richard H. Thomas' *The History of the Society of Friends in America;* Holder's *The Quakers in Great Britain and America,* and the various books of discipline.

Friends of the People, a British society called into being in 1792 by the French Revolution. Its object was to secure parliamentary reforms not by agitation but by ordinary constitutional means. The society included Lords John Russell, Kinnaird, and Edward Fitzgerald, also Sir James Mackintosh, Dudley North, Erskine, and Sheridan. Its reform bills, however, received little support and it eventually passed out of existence.

Friends of the Temple, a sect which arose in Germany (*c.* 1840) under the leadership of Rev. Christopher Hoffmann, the principal aim of which is the gathering of the people of God in Palestine. They accept the law of Moses and the Gospel of Christ, believe in the coming fulfilment of all Scripture prophecy, and leave to individual choice the use of baptism and the Lord's Supper. Looking to its chief aim, colonies have been established in Palestine—at Joppa, Sharon, Haifa, Jerusalem, and other places. They have a few 'temples' (spiritual communities) in the United States, one in Württemberg and one in Alexandria, Egypt. Consult Hoffmann's *Occident und Orient.*

Fries, frēs, ELIAS MAGNUS (1794–1878), Swedish botanist, was born in Femsjö, Smaland. He was educated at the University of Lund, where, in 1824 he became professor of botany. Appointed to the professorship of practical economics at Upsala in 1834, after the death of Wahlenberg in 1851, he united with it that of botany. He published numerous botanical works, of which his *Systema Mycologicum* (1821–32) remains a standard authority on fungi, and *Monographia Hymenomycetum Sueciæ* (1857–63) is one of the most important. He also wrote on lichens, and on the flora of Scandinavia.

Fries, JAKOB FRIEDRICH (1773–1843), German philosopher, was born in Barby, near Magdeburg. He was educated at the universities of Leipzig and Jena and in 1805 was appointed professor of philosophy and mathematics at Heidelberg, but went to Jena in 1816 to occupy the chair of speculative philosophy. His philosophical standpoint differed from Kant's mainly in what he held to be the basis of philosophy—namely, psychology. His work is not, however, generally held to have been of lasting value. His works include *Philosophische Rechtslehre* (1803); *System der Philosophie* (1804); *Neue Kritik der Vernunft* (1807); *System der Logik* (1811); *Julius und Evagoras,* a philosophical romance (1822); *Die Lehren der Liebe, des Glaubens und der Hoffnung* (1823); *Geschichte der Philosophie* (1837–40).

Fries, JOHN. See FRIES REBELLION.

Frieseke, frē'ze-kē, FREDERICK CARL (1874–), American artist, was born in Owosso, Mich. He received his art education at the Art Institute of Chicago, the Art Students League, New York City, and the Julian Academy and Whistler School, Paris. He has lived much of his life in Paris and has received many medals and prizes, among them the grand prize for painting at the Panama Exposition, 1915, and a gold medal in Munich. He is a member of the National Academy. He belongs to the Impressionistic School and his work is usually female figures, often in the nude, pictured in brilliant settings. He is represented in the galleries of Venice; Odessa; the Luxembourg, Paris; the Metropolitan Museum, New York City; Chicago, Detroit, and other American cities.

Friesland, frēz'land, province, Netherlands, in the extreme northern part; area, 1,248 square miles. The surface is only just above, in some parts even below, the level of the sea, and inundations have been relatively frequent. The province is famous for its horses, cattle, and sheep. Fishing is an important industry. The capital is Leeuwarden. Pop. (1938) 422,333. See FRISIANS.

Fries Rebellion or **Insurrection,** an uprising in Eastern Pennsylvania in 1799, led by one John Fries (*c.* 1764–1825). By act of July 14, 1798, Congress imposed a direct tax of $2,000,000, which was to be equitably apportioned among the various States and which was laid upon all dwelling houses and lands, and on slaves between the ages of twelve and fifty. The value of the dwelling houses was to be determined on the basis of the size and number of windows in these houses, and an impression thus got abroad that citizens, who owned houses, were being taxed for having windows, the tax thus coming to be known in some communities as a 'window tax.' In the Eastern counties of Pennsylvania (Northampton, Bucks, Montgomery, Lehigh, and Berks), the large German element vigorously opposed the tax, and under the leadership of Fries, resisted by force (March, 1799) the Federal officers sent to measure windows preparatory to assessing the owners of dwelling-houses.

Riots soon broke out; some thirty of the rioters were arrested; and at Bethlehem these arrested rioters were rescued by their associates led by Fries. President Adams issued a proclamation (Mar. 12) against the rioters, troops were called out, and the disturbances were quickly suppressed. Fries was arrested, was tried on a charge of treason—the first trial of the sort in the history of the United States—and was convicted (1799). A new trial, however, was granted, but in the following year Fries was again convicted and was sentenced to the gallows. It was partly for the high-handed manner in which Judge Chase conducted this trial that he was im-

peached by the House and tried before the Senate. (See CHASE, SAMUEL.) Fries was pardoned by President Adams, and subsequently became a prosperous dealer in tinware in Philadelphia. See Fisher, *Pennsylvania, Colony and Commonwealth* (1897), and Davis, *The Fries Rebellion* (1899).

Frietchie, BARBARA (1766–1862), was born (Hauer) at Lancaster, Pa. She was the daughter of German immigrants, and was married to John Caspar Frietchie, of Frederick, Md., in 1806. The incident of her waving a Union flag at the Confederate troops as they marched by her house on Sept. 10, 1862, made use of by Whittier as the subject of a poem, is generally regarded as mistaken, Whittier having been misled by the confusion of Mrs. Frietchie with another resident of the same street. It is almost certain that 'Stonewall' Jackson did not pass through that street, but his troops marched that way, and, it is stated, attempted to remove a Union emblem from Mrs. Quantrell's house against orders. Three or four days later, Mrs. Frietchie, a woman of 95, greeted the advancing Union troops by waving a flag from her porch, and Whittier confused the two incidents. She died later in that year.

Frieze, strictly speaking, that part of the entablature of a building which forms a band between the architrave and the cornice, but more freely used to designate the decoration applied to that portion. The decoration varies with the order of architecture. In Doric examples it is divided into equal sections by raised portions with three angular flutes. The fluted sections are called *triglyphs*, the spaces between, *metopes*. The metopes are sometimes left plain, and sometimes—as in the Parthenon—richly decorated. In Roman buildings the decoration frequently takes the form of ox-skulls and wreaths. When not so divided, the ornament often offers a continuous design, sometimes of men and animals, illustrating some theme, oftentimes floral. Familiarly, in domestic architecture, the word frieze is applied to the band of decoration just below the cornice of an interior.

GODS FROM OLYMPUS ASSISTING IN THE CEREMONY OF PRESENTING THE VEIL TO ATHENE. RELIEF OF THE EASTERN FRIEZE OF THE PARTHENON. MUSEUM OF ATHENS.

Frigate. Originally, the name was applied in the Mediterranean to a kind of long vessel navigated with sails and oars. In 1649 it was applied to a class of small fast-sailing ships built for the British navy. When the Seven Years' War broke out, the frigate class, as technically known, first came into existence, the first of the type being the *Southampton*, of thirty-two guns, built in 1757. These frigates were originally fast full-rigged vessels of from 600 to 700 tons burden, designed for scouting and cruising duties, and the essential feature in them was that they carried all their guns on a single deck. The size and armament were from time to time increased, and by 1800 some of them carried as many as fifty guns, though nominally rated as 44-gun ships. The frigates *Constitution*, *United States*, and *President*, of the United States navy, were vessels of this sort.

Frigate-bird, or MAN-OF-WAR BIRD, a member of the sub-order Steganopodes, and one of the swiftest and most active of marine birds. Truly pelagic in habit, it feeds entirely upon fish, and rarely comes to land except at the breeding season. The food is sometimes obtained at the surface of the water, but very frequently the frigate-birds compel other birds to disgorge their prey, and catch the falling fish before it reaches the water. The great frigate-bird (*Fregatus aquila*) is found

in the warmer parts of the great oceans; the lesser (*F. minor*) is confined to the Indo-Pacific Ocean. The body is slender, the neck short, the beak elongated and strongly hooked, the legs short and feathered to the toes, the wings and forked tail elongated and pointed. The greater frigate-bird is about four feet in length, with a wide expanse of wing, and is brownish-black in color, with metallic reflections, and a scarlet patch on the throat.

Frigga. See FREYJA.

Frilled Lizard (*Chlamydosaurus Kenti*), a very curious reptile found in Queensland and other parts of Australia, and belonging to the lizard family Agamidæ. It reaches a length of about thirty-two inches, and receives its name from the presence of a large expansion of the skin at either side of the neck, the two halves meeting at the throat. This frill is notched at

Frilled Lizard.

the edge, has special supporting cartilages, and by means of muscles can be folded or expanded at will. The lizard walks upon its hind limbs like the extinct iguanodon, having the fore limbs hanging down. When at bay, it expands the frill to its fullest extent, and opens the mouth wide, showing the powerful teeth—an attitude which possibly is of use in frightening some of its enemies. It inhabits sandy districts.

Fringe Tree, a hardy North American shrub, *Chionanthus virginica*, so called on account of its finely segmented corolla. It is a moisture-loving shrub, and given that condition, it is not difficult of cultivation. In May it bears abundant and graceful terminal racemes and fragrant white flowers. It is easily raised from seeds, or may be propagated by layers.

Fringillidæ. See FINCH.

Frisians, a Germanic people (Frisii) who for close upon two thousand years and more have dwelt on the shores of the North Sea, between the Scheldt and the Elbe, and thence northward as far as the coast of Jutland. They were subject to the Romans from the time of Drusus to about the end of the 1st century A.D. After a struggle of nearly two hundred years with the Franks, they were subjugated by Charlemagne. Christianity was introduced among them in the 7th century by Wilfrid, archbishop of York, and by Willibrord. In the antecedent heathen period their religious centre was the island of Heligoland. They were, and still are, a capable sea-faring race, and have always been animated by a strong instinct of freedom. Politically they never formed one united people, but were governed by a number of small chieftains; though in E. Friesland the dynasty of Cirksena ruled from 1430 to 1744. With the Angles and the Saxons bands of Frisians settled in England in the 5th century. The region which they inhabit may be briefly described as the crumbling fringe of the continent of Europe, and their annals are full of dramatic incidents connected with their century-long struggles against the encroaching ocean. In this conflict the most memorable events have been the formation of the Zuider Zee by an irruption of the sea in 1282, the gradual formation of the Dollart during the 13th and 14th centuries, and the destruction of the former island of Nordstrand by a terrific gale in 1634. But the sea has always gone on unceasingly breaking down the islands. For example, in the middle of the 13th century the N. Frisian islands alone were estimated to cover nearly 1,100 sq. m., an area reduced by the middle of the 19th century to less than 110 sq. m. On the other hand, the Frisians have as persistently reclaimed an equivalent to what the sea has engulfed. Since the middle of the 16th century close upon 150,000 acres have been thus restored to cultivation. The long chain of the Frisian islands —Texel, Vlieland, Terschelling, Ameland, Schiermonnikoog, Norderney, Pellworm, Amrum, Föhr, Sylt—are separated from the mainland by shallow mud-flats (*Watten* or *Wadden*), often dry at low water. They afford excellent grazing in summer. Norderney (immortalized by Heine), Sylt, and others are much visited for sea-bathing. See the useful summaries of Dr. Eugen Traeger, *Die Halligen der Nordsee* (1892); C. P. Hansen, *Die Chronik der friesischen Uthlande* (1856); and C. Jensen, *Vom Dünenstrand der Nordsee* (1901).

Frissell, HOLLIS BURKE (1851-1917), American educator; born at Amenia, N. Y.; was graduated at the Union Theol. Sem., New York, in 1879; ordained in Presb. Church in 1880; chaplain of Hampton (Va.) Institute in 1880-93; then became president.

Frith. See FIRTH.

Frith, or FRYTH, JOHN (1503–33), English ecclesiastic, born at Westerham, Kent. In 1526 he was accused of heretical teaching and imprisoned. On his release (1528) he fled to Marburg, where he assisted Tyndale in his literary work. His own *Disputacyon of Purgatorie* appeared in 1531. Returning to England in 1532, he was burnt at Smithfield.

Frith, WILLIAM POWELL (1819-1909), English painter, born at Aldfield, in Yorkshire, was elected A.R.A. in 1845 and R.A. in 1853. His early pictures are chiefly in illustration of Shakespeare, Scott, Goldsmith, and Dickens, and characterized by the conventionalities of early Victorian art; but in 1852 he realized his desire to reproduce contemporary life. His large canvases are crowded with typical figures, accurately drawn, and grouped without confusion of effect. Among the most celebrated are *Ramsgate Sands* (1854), *The Derby Day* (1858), *The Railway Station* (1862), *The Marriage of the Prince of Wales* (1861), and *The Road to Ruin* (1878). See his *My Autobiography and Reminiscences* (1887–8) and Muther's *History of Modern Painting* (1896).

Fritillary, a genus of liliaceous plants, characterized by bearing solitary flowers, each with six petals, and a nectary to each petal. The common fritillary or snake's head of Europe is a bulbous plant, with narrow leaves, and a curiously checkered, drooping, purplish flower which appears in spring. A stately fritillary is the crown imperial (*Fritillaria imperialis*), which thrives in a rich, deep garden soil, and shoots up, bearing crowned leaves, to four feet in April or May. There are varieties displaying various combinations of red, yellow, and orange. Most of the other fritillaries are dwarf bulbous plants, which thrive in rich, light soil, preferably in the partial shade of deciduous trees. The commoner kinds are very suitable for naturalization in grass or woodland. Most fritillaries produce sombre-colored, curiously - checkered, snaky-looking, pendulous flowers. A western species (*F. Kamtschatcensis*) furnishes an important vegetable to the Alaskan Indians. The squaws dig the tiny bulbs in autumn, and, stored in grass sacks for the winter, boiling re-

duces them to a pasty, tasteless condition.

Fritsch, Gustav Theodor (1838), German naturalist and traveller, born at Kottbus. He visited Bechuanaland (1863–6), Egypt, Asia Minor, and the E. Mediterranean; was sent by the Prussian government to Aden (1868) to observe a total eclipse of the sun, and to Ispahan (1874) for the transit of Venus. Among his works are *Drei Jahre in Südafrika* (1868); *Die Eingeborenen Südafrikas* (1872); *Südafrika bis zum Zambesi* (1885); and *Die elektrischen Fische* (1887–90).

Fritz, John (1822–1913), American iron and steel expert, born at Londonderry, Pa. He was employed in the iron works at Norristown, Pa., where he became mill foreman. In 1852, with some associates, he started a small machine shop, and two years later was made general superintendent of the Columbia Iron Works at Johnstown. In 1860 he became general superintendent and engineer of the Bethlehem Steel Works. He constructed the works of this company. He was one of the first to introduce the Bessemer steel process into the U. S. In 1893 he was elected an honorary member of the Iron and Steel Institute of Great Britain, which awarded him the Bessemer gold medal for services in the advancement of steel manufactures. In 1897 he was selected to make plans for a government armor plate works. A medal to be awarded for discoveries in industry and science was established in his honor in 1902 by a group of American scientists and manufacturers.

Fritzner, Johan (1812–93), Norwegian philologist, born at Askö, near Bergen; was assistant at cathedral school at Bergen, and subsequently pastor at Vadsö. His chief work is the admirable Icelandic-Danish dictionary, *Ordbog over det gamle norske Sprog* (2d ed. 1883–96).

Friuli, dist., N. Italy, formerly an independent duchy which embraced the present provinces of Udine, part of Venice, and part of Görz and Gradisca.

Froben, or Frobenius, Johannes (1460–1527), German printer and scholar, born at Hammelburg (Franconia); founded a printing-house at Basel in 1491. He first published an edition of the Scriptures in Latin, and of the New Testament in Greek, besides the works of the fathers. He was the first to introduce the Latin character into German printing; his work gained a high reputation for accuracy and artistic value, designs for titles, etc., being contributed by Holbein. See monograph by F. L. Hoffmann (1867).

Frobisher, bay, British N. America, running into Baffin Land between Hudson Strait and Cumberland Sound; named after Martin Frobisher, who discovered it in 1576. It is about 250 m. long and 20 m. broad.

Frobisher, or Frobiser, Sir Martin (?1535–94), English navigator, was born probably in Yorkshire. He was the first Englishman to attempt a north-west passage to Cathay. After fifteen years of continued disappointment, he was helped by the Earl of Warwick and others to fit out three small craft, with which he started in June, 1576. He returned to England on October 2. On May 31 following (1577) he again set out, and came back in September with an account of the discovery of ore near Hall's Island, in Frobisher Bay. In 1578 Frobisher started once more, and returned in October. In 1585 Frobisher sailed with Sir Francis Drake on the profitable expedition to the West Indies. In 1588 he distinguished himself against the Spanish Armada. He commanded a squadron two years later off the Spanish coast, and in 1594 he went to the aid of Henry IV. of France. During an assault on a fort near Brest he was wounded in the hip, from which he died at Plymouth. See Jones's *Life of Frobisher* (1878), and Hakluyt Society's *Three Voyages of Frobisher* (1867).

Froebel, Friedrich Wilhelm August (1782–1852), German educator, born at Oberweissbach (Thuringia). From 1807 to 1809 he worked under Pestalozzi at Yverdon. In 1816 he established a small school at Griesheim, but transferred it after a time to Keilhau (both places in Thuringia). An attempt to introduce his system into Switzerland, in Lucerne, was frustrated by the opposition of the priests; but a training school for teachers at Burgdorf, in the canton of Bern, met with success. Realizing the importance of the training of children before the age of seven—a subject with which he deals in his *Menschenerziehung*, vol.i. (1826)—Froebel opened in 1837 the first kindergarten, at Blankenburg, near Keilhau. Devoting himself later to the training of women as teachers, his labors were interrupted by the edict of 1852, forbidding the establishment in Prussia of schools on the principles which he advocated.

Courtesy American Museum of Natural History

PICKEREL FROG

The basis of the Froebel system of education was development through voluntary activity; he held the object of all training to be the assistance of both mind and body to develop along the lines of natural growth. Man being an organism must be treated as such, and hence perfection in the early stages will, granted a suitable environment, ensure corresponding perfection in the adult stage. It was to provide a suitable training for the early stage, hitherto generally neglected, that the kindergarten system was established. His works on education were edited by W. Lange (1850) and Seidel (1883). See Eng. trans. of *The Education of Man*, by Jarvis (1885), and by Hailman (1887). See *Life*, in

German, by Hanschmann (1900); reminiscences by Marenholtz-Bülow, trans. by Mrs. Horace Mann (1887); also memoir by H. C. Bowen in the Great Educators Series, ed. by N. M. Butler (1897); and Froebel's *Autobiography* (Eng. trans. 9th ed. 1903).

Frogbit (*Hydrocharis morsus-ranæ*), a floating European plant (Hydrocharidaceæ). It has heart-shaped or kidney-shaped leaves, and bears white flowers in late summer, male and female flowers occurring on different plants. In America the aquatic, *Limnolium Spongia*, is known by this name.

Frog-hopper, a popular name given to certain insects belonging to the order Hemiptera and the family Cercopidæ. The common frog-hopper is *Aphrophora spumaria*, a small gray insect about a quarter of an inch long, with four similar wings. They feed upon the juices of plants, and form the frothy substance known as frog-spit, or 'cuckoo-spit'; hence also

Frog-hopper and 'Cuckoo-spit.'

the name of 'froth fly.' Within these lumps of white froth lies the small white larva with its prominent black eyes. As the name indicates, the adults are capable of active jumping movements. The myth of the connection between the froth of the larva and the frog or cuckoo is as old as Aristotle.

Frogmore. See WINDSOR CASTLE, and for illustration see MAUSOLEUM.

Frogmouth, a member of the family Podargidæ, which includes some curious wide-mouthed birds, usually placed nea the night-jars. The frogmouths range from India to Australia; all have mottled plumage, but either build nests or lay their eggs in hollow trees.

Frogs are aquatic amphibians of the tailless order Anura, and the family Ranidæ, distinguished from their fellow-anurans, the toads, by having teeth in the upper jaw, the lower bones of the shoulder-girdle firmly conjoined, a smooth skin and the tympana visible, and webbed toes; while they differ from the tree-frogs in having the toes free from viscid disk-pads and in other features. Frogs occur in most parts of the world having a moderate climate, and make their home more or less continuously in and about stagnant water, some never leaving it for more than a few hours, while others resort to the water only in the egg-laying season, after which (as in the case of our American buff-and-black wood frog, *Rana sylvatica*) they betake themselves to the woods and remain there, searching among the fallen leaves for insects and worms, until the next spring. Other species wander more or less, while some inhabit the water continually, feeding upon anything and everything edible which they are able to catch above or beneath the surface. During the winter the thoroughly aquatic species conceal themselves in the mud, going into a cold torpor, where the climate is severe, until revived in the spring; others bore into the soil, or beneath the fallen leaves, or into rotting stumps, etc., and exist quiet and lethargic. The early spring brings them out, and all species hasten to the water, where they croak loudly (in some species only the males, in others both sexes, joining in the chorus) during the process of mating and egg-production. At this season the males may be distinguished by seasonal marks, as brighter colors, a swollen fore-finger, or some other unusual feature. The eggs are laid in a long, string-like tube of gelatinous matter, which forms an irregular mass; and the male, sitting on the back of the female, fertilizes them as they exude from her. The parents pay no attention to the eggs after they have been laid, but leave them glued to or entangled in the swamp vegetation.

In about a fortnight's time the larvæ or 'tadpoles' wriggle from the jelly-envelope into the surrounding water. They are fish-like, without limbs, with external gills, and with a swimming tail. At first very inactive, these tadpoles soon begin to swim about freely, feeding on vegetable food or on refuse of various kinds; they soon lose their external gills, but acquire internal ones like those of a fish. Henceforth growth is rapid; hind limbs appear, and gradually increase in size, and the tadpole, especially if the water be foul, comes to the surface to breathe, showing that lungs are developing. About three months after hatching, the fore limbs, which have been concealed within the gill-chambers, are suddenly revealed, the tadpole ceases to feed, its tail gradually diminishes in size, and finally, the metamorphosis complete, it hops on shore as a tiny frog. After quitting the water the little frogs spend the remainder of the warm season on land, before beginning hibernation in the autumn.

The commoner frogs of the United States are the bull-frog (*Rana catesbiana*), largest of all (5 to 8 in.), greenish, brightest on the head, faintly spotted on the back and blotched on the legs, which occurs from Kansas eastward, and is famous for its sonorous bass notes. Its hind legs, fried, are eaten, especially in the central states. Very numerous and widespread are the spring frog (*R. clamatans*), length 3 in., green and black-spotted above, white below; the common green frog (*R. virescens*), 2¾ in. long, green, with irregular black blotches above and a paler belly; the smaller and less aquatic pickerel frog (*R. palustris*), which is light brown with two rows of large oblong square blotches of dark brown on the back, and spots elsewhere; and the terrestrial wood-frog heretofore mentioned. Frogs are very useful in keeping down the mosquitoes and other insect pests bred in stagnant waters by devouring their eggs and larvæ; and themselves furnish a large part of the food of many mammals, birds, and reptiles. For American species see Jordan's *Manual of Vertebrates* (new editions frequently), and *The Standard Natural History* (Vol. iii. 1885).

Among allies of the frog, mention should be made of the curious flying frog (*Rhacophorus pardalis*) from Borneo and the Philippines, which has the webs of the fingers and toes so expanded as to form parachutes, and is apparently capable of taking 'flying jumps.' In an allied species (*R. Reinwardti*) there is a fringe on the forearm, in addition to the expanded webs, which suggests the beginning of a flying membrane. See AMPHIBIA.

Frogs have for a long period been used for dissecting purposes, in order to acquaint students with the outlines of vertebrate anatomy. They furnish also the material for many physiological experiments. See Mivart's *Frog* (Nature Series, 1873), and zoölogical text-books generally.

Frohman, CHARLES (1860–1915), American theatrical manager, was born in Sandusky, O., and was educated in the public schools of New York City. As a youth he was in the office of *The Daily Graphic*, New York, and in the evenings sold tickets for Hooley's Theatre, Brooklyn. At eighteen he was advance agent for Haverly's Mastodon Minstrels. In 1888 he bought the

rights of Bronson Howard's *Shenandoah*, and by judicious management made of a comparative failure the theatrical success of the following season in New York. In 1890 he obtained a lease of the Madison Square Theatre in New York, and in 1893 opened the Empire Theatre with Belasco's *The Girl I Left Behind Me*, which was followed by a long list of successful plays. In 1895 he was the leading spirit in the formation of a powerful syndicate of American theatre owners and managers. He was the manager or lessee of the Empire, Criterion, Savoy, Garrick, Knickerbocker, Herald Square, and other theatres in New York, and was interested in a number of theatres in London. He was known as an indefatigable worker, and he helped to prominence many well-known actors and actresses, including Maude Adams, John Drew, and Julia Marlowe. He lost his life when the Cunard liner *Lusitania* was sunk on May 7, 1915, by a German submarine, during the European War.

Frohman, DANIEL (1853), American theatrical manager, brother of Charles, born in Sandusky, Ohio. After five years in the business office of the New York *Tribune*, he became in 1884 manager of the Lyceum Theatre, where he maintained a stock company for eighteen years, producing plays, chiefly of a society character, by DeMille, Bronson Howard, Clyde Fitch, and other American and English writers. In 1898 he leased Daly's Theatre, and in 1903 opened the New Lyceum Theatre. Georgia Cayvan, E. H. Sothern, Helene Dauvray, and Annie Russell came into prominence under his management. He has brought to the United States several musical celebrities, among others the boy-violinist, Vecsy. In 1904 he married Margaret Illington, an actress.

Frohschammer, JAKOB (1821–93), German theologian and philosopher, born at Illkofen, near Ratisbon. In 1850 was published his first book, *Beiträge zur Kirchengeschichte*, which was placed on the 'Index Expurgatorius.' In 1855 he became professor of philosophy at Munich. In 1861 he published *Ueber die Freiheit der Wissenschaft*, in which he upheld the independence of science from theological control. Next year he founded the *Athenäum*, the organ of Liberal Catholicism, but refused to join forces with Döllinger and the Old Catholic movement. In it he wrote the first adequate account in German of the theory of natural selection. He was excommunicated in 1871, and replied by a series of three pamphlets (in Eng. as the *Romance of Romanism*, 1878). His principal works, in addition to those named, are *Die Philosophie als Idealwissenshaft und System* (1884) and *System der Philosophie im Umriss* (1892).

Froissart, JEAN (1337–1410?), French chronicler, was born at Valenciennes. At the age of eighteen he went to England, where he spent a year under the patronage of Philippa of Hainault, his countrywoman. At the age of twenty he began to write his history; and having completed the first section, he began his travels (1361–1366). Returning to England, he made an excursion into Scotland about 1364. Froissart accompanied the Black Prince to Dax, and the Duke of Clarence to his marriage at Milan. He was appointed in 1369 to the cure of Lestines. In 1395 he once more visited England. In 1372 he began to write his famous *Chroniques*, which describe events in Western Europe from 1326 to 1400. It is not reliable from a historical point of view, but it presents a picture of the time

Development of the Frog.

1. Eggs before leaving the ovary; 2, eggs shortly after laying; 3, tadpole before hatching; 4, tadpoles just hatched; 5, tadpoles with external gills; 6, 7, tadpoles with opercular folds; 8, 9, tadpoles with developing hind legs; 10, tadpole during metamorphosis; 11, young frog with tail not completely absorbed; 12, mature frog.

which is unrivalled in its vivid color and its charm. The editions by Buchon (1824) and S. Luce (1869–93) are good. The English translation by Johnes (1873) is generally used; Henry Newbolt has published (1900) the portions dealing with Britain. See Madame Darmesteter-Robinson's *Froissart* (Eng. trans. 1895); article by Sir Walter Scott, *Edin. Rev.*, Jan. 1805; and Kervyn de Lettenhove's *Froissart* (1858).

Frome, or FROME SELWOOD. mrkt. tn. on the Frome R., 12 m. s. of Bath, Somerset, England. The woollen trade, which was for long the staple industry, is declining. Art metal works now take the first place. Pop. 11,055.

Fromentin, EUGÈNE (1820–76) French painter and writer, born in La Rochelle. His first inclination towards art showed itself in 1840. The pictures of Marilhat, exhibited in 1844, inspired him with a passion for the East, and in 1846 he made his first visit to Algiers. His earliest Salon pictures were two Algerian sketches and a French landscape, in 1847; and after a second and third visit to Algiers he published his impressions, in *Une Année dans le Sahel* (1859; new ed. 1888) and *L'Été dans la Sahara* (1857; new ed. 1888). His *Maîtres d'Autrefois*, a subtle critical study of the Dutch and Flemish painters, was not published until 1876. His paintings have definite personal charm and vivid delicate effects of color and of atmosphere, but are less scientific than the work of his noted *confrères*. He was an acute critic of the technique of painting, and shows keen observation and study of the effect of sunlight on color. Some of his best works are in the U. S.: *Crossing the Ford*, and *Arabs Watering Horses*, in a private collection in New York, while his *Encampment in Atlas Mountains* is in a Baltimore collection. See Louis Gonse's *Eugène Fromentin* (1881).

Frond is the name applied to the so-called leaves of ferns; but it is the scales on the fronds that are really the leaves. Functionally, however, the fronds serve as leaves; but they also produce sporangia containing spores. See FERN.

Fronde, a general name for the party or parties in France which were hostile (1648–53) to the rule of Mazarin during the minority of Louis XIV. The first leaders of the party were the parlements (courts of law), especially the Parlement of Paris. But their forces were defeated by the Prince of Condé, acting for the court party, at Charenton (1649). Condé, however, quarrelled with Mazarin, who arrested Condé, his brother Conti, and brother-in-law Longueville. This roused the nobles generally. Mazarin withdrew into exile, and Condé was released. Shortly afterwards Louis XIV. came of age, recalled Mazarin, and put his forces under the command of Turenne, who defeated Condé just outside Paris (1652). This led to the final victory of the court party and of Mazarin. See Fitzpatrick's *Great Condé* and *the Period of the Fronde* (ed. 1874); Sainte-Aulaire's *Histoire de la Fronde* (ed. 1860); and Chéruel's *Histoire de la France* (7 vols. 1878–82).

Frontenac, FORT, a former fort built on the site of the present Kingston, Canada, in 1674. It was granted (1675) to La Salle, who rebuilt it, and who intended to use it both as a fur-trading station and as a base for his explorations. In 1683, during La Salle's absence, Gov. La Barre seized it on the pretext that La Salle had not maintained the prescribed garrison; but La Barre was forced to restore the fort in 1684. Fort Frontenac was demolished in 1689, but was reestablished by Count Frontenac in 1696. In 1758, during the French and Indian War, the fort was captured by the English under Bradstreet—this being an important success, inasmuch as it gave the English control of Lake Ontario and practically cut New France in two.

Frontenac, LOUIS DE BUADE, COMTE DE (1620–98), succeeded Courcelles as governor-general of New France in 1672, holding the office until 1682, and again from 1689 to 1698. During his first administration he displayed great ability in dealing with the Indians and in his encouragement of the French explorers, Joliet, Marquette, and La Salle, who, with Frontenac's assistance, established posts at Mackinac, Niagara, and in the Illinois country. When he returned to Canada in 1689 he found the country almost ruined by the Iroquois tribe of Indians, against whom he at once began a relentless war, but whom he did not succeed in entirely subduing until his final campaign in the Mohawk country in 1696. During this time he also persecuted their allies, the English, ravaging the coast towns of New England and to the south as far as New Jersey. He also captured Salmon Falls, and Schenectady, and in 1690 repulsed the forces of Sir William Phips before Quebec. See Parkman's *Count Frontenac and New France under Louis XIV.* (1877), and Winsor's *Cartier to Frontenac* (1894).

Frontinus, SEXTUS JULIUS, prætor of the city of Rome in 70 A.D., and governor of Britain from 75 to 78 A.D., during which period he conquered the Silures. In 97 he was appointed superintendent of the aqueducts; he was also an augur. He died about 106 A.D. He wrote a work on the art of war, edited by Gundermann (1888; Eng. trans. by Richard Morysine, 1539). See also edition of the *De Aquis Urbis Romæ* by Herschel (trans.), *Two Books on the Water Supply of the City of Rome* (1899).

Fronto, M. CORNELIUS, Roman rhetorician of the 2d century A.D., tutor of Marcus Aurelius and Lucius Verus; became senator, and consul in 143. Of his works, only a feeble treatise *On the Differences of Words*, and a number of letters addressed chiefly to Antoninus Pius and Marcus Aurelius, are extant. Editions: Niebuhr (1816) and Mai (1823).

Front Royal, a locality in the Shenandoah Valley, near the junction of the two forks of the Shenandoah River. Here on May 23, 1862, about 1,000 Federals (part of Gen. Banks's army), under Col. Kenly, were captured by Gen. 'Stonewall' Jackson.

Frosinone, tn., Italy, prov. Rome, 53 m. by rail S.E. of Rome. It has some trade in wine. Pop (1936) 18,447.

Frost. When the temperature of the air falls to 32° F. or below, there is said to be a frost. Frost, in other words, consists of the moisture always present in the air condensed at freezing temperatures upon plants and other objects near the surface of the earth. Whereas dew is formed when the moisture in the atmosphere is condensed in contact with objects at the earth's surface at temperatures above freezing, frost occurs when the temperature falls below 32°. While the temperature of the air a few feet above the surface of the earth is often above the freezing point during the process of frost formation, yet the plants and other objects on which frost is formed may be at the freezing temperature. These plants and other objects lose during the night, by radiation, the heat which has been received during the day from the rays of the sun, and as this heat is radiated and the moisture evaporated, the temperature of the plants naturally falls. Furthermore, cold air, which is heavier than warm air, settles down into the valleys in contact with the vegetation, and for this reason low districts in the country often experience frost when higher points escape. As frost produces great damage to plants during their early spring growth and also to crops maturing

in the autumn, it is studied by meteorologists as a matter of great economic importance, and the United States Weather Bureau has devoted much attention to the subject, so that it is able to predict the occurrence of frost to fruit growers and other farmers in such districts as Southern California, Florida, and other places where the fruits or harvests are likely to be seriously damaged.

According to the Weather Bureau the occurrence of frost depends largely on local conditions, though, in a general way, a prediction can be made for considerable territory. It is most likely to occur on a clear, cloudless, and calm night, as the absence of clouds facilitates radiation and aids the escape of the heat derived from the sun during the day to the upper air. Furthermore, on such occasions, cold air of great density is able to settle to the earth without being disturbed by the wind. The presence of moisture-laden winds in a region is likely to render it less liable to frost, and for this reason certain parts of the Gulf States are protected, owing to the presence of large bodies of water over which the winds blow. Growing crops can be protected from frost by means of glass, cloth, or lath screens, or by covering the plants with straw, or in the case of cranberries flooding the marshes when frost is expected. Small fires producing intense smoke are also used in some sections of the United States.

In addition, there are various methods for charging the air with moisture, such as the use of evaporating pans and boilers, or spraying and sprinkling the plants when frost is threatened. Irrigation also furnishes protection from frost, while heating the air by means of fires to produce a strong upward draft has been used in a number of fruit orchards. The United States Weather Bureau distributes warnings by telegraph, and telephone, usually in sufficient season to enable farmers to use whatever safeguards are available to protect their fruit or other crops. In the United States a damaging frost is likely to occur in the region bordering the Gulf of Mexico and in the Pacific Coast States in the latter part of October, until early April. In the Northern Pacific Coast States it occurs as early as October, and may be encountered as late as the last week of April. Central and even Southern Florida is likely to experience frost from December until early in March, while the period of severe frost for the South Atlantic and Gulf States ranges from November to April. The upper Mississippi and lower Missouri valleys, Kansas, and Nebraska, where there are considerable agricultural interests, are likely to experience damage by frost from October to April, while from September to May frost is usually confined to the extreme upper Mississippi, upper Missouri, and Red River of the North valleys, and the Rocky Mountain and Plateau regions from Central New Mexico and the Texas panhandle northward. In the summer months from June to August frosts are very infrequent and occur practically only in mountainous districts and the northern tier of States.

Frost, Arthur Burdett (1851–1928), American illustrator, was born in Philadelphia, Pa. As a lad he took up wood-engraving and lithography, studying drawing by himself meanwhile, and at the age of 21 was already successfully illustrating books. He passed the year 1877–8 in Europe and later made his permanent home in Morristown, N. J. The humor of his illustrative work is entirely natural, and he is particularly happy with his drawings for *Rudder Grange* (1879) and others of Stockton's books. He is perhaps at his best in depicting the comic mishaps of the amateur farmer. His publications include *Stuff and Nonsense* (1888), *The Bull Calf, and Other Tales* (1892), *The Golfer's Alphabet* (1898), *Book of Drawings* (1905).

Frost, Edwin Brant (1866–1935), American astronomer, was born in Brattleboro, Vt., and gathered a wide scientific training at Dartmouth College, Princeton, Strassburg and Potsdam Observatory. After serving as instructor in physics and astronomy at Dartmouth and director of the observatory, he became professor of astronomy in 1895. He was professor of astrophysics at the University of Chicago (1898) and from 1905 until 1932 he was director of the Yerkes Observatory, when he retired, blind. From 1902 he was editor of the *Astrophysical Journal* until blindness overtook him. His autobiography, *An Astronomer's Life,* appeared in 1933.

Frost, John (1800–59), American compiler of histories and biographies for popular reading, was born in Kennebunk, Me. In 1845 he began to publish books. They were often illustrated, and were very popular. Among them are *Pictorial History of the United States* (2 vols.), *Picture History of the World* (3 vols.), *Book of Heroes, Book of the Army, Book of the Navy.*

Frost, Robert (1875–), American poet, was born in San Francisco. When a young boy he removed with his mother to Lawrence, Mass., and after studying at Dartmouth and at Harvard became a farmer and later a teacher in Pinkerton Academy, Derry, N. H. He went to England in 1912 where he remained several years, publishing there his first two volumes of verse. In 1916–20 he was professor of English at Amherst College, and after a short interval again occupied that position in 1923–25. In 1925 he was called to the University of Michigan to hold a life fellowship in poetry but he soon returned to his farm in Vermont. In 1926–27 he gave lectures and readings and in 1928 returned to Amherst as professor of English. His poetry, which is of a high order of merit, sympathetically portrays every day country life in New England. Among his publications are *A Boy's Will* (1913); *North of Boston* (1914); *Mountain Interval* (1916); *New Hampshire* (1923); *West-running Brook* (1928); *A Way Out* (1929); *Collected Poems* (1930). He won the Pulitzer prize for poetry in 1924 and 1930, and the Loines prize in 1931.

Frost, William Goodell (1854–), American educator, was born in Le Roy, N. Y. He was graduated (1876) from Oberlin College, studied at Worcester, Harvard, and Göttingen. In 1879 he accepted the chair of Greek language and literature at Oberlin, holding this position until 1892. After a year of travel and study, he was elected president of Berea College, Ky., until 1920. This school, founded by antislavery Southerners, received both white and colored students with no trouble until the intervention of a State law in 1904, when Frost founded a separate school for the colored at Lincoln Ridge. He won attention to the need and worth of the Southern mountaineers, and with expert advice blocked out a college with adjacent schools, each with its own adaptations to a particular population group—Normal, Academy, Elementary, Vocational, and 'Foundation School' for retarded adults—as well as extension service for eight mountain States. For this enterprise he obtained gifts of more than $10,000,000. His publications include *A Greek Primer, Introductory to Xenophon* (1889); *Inductive Studies in Oratory* (1890); *University Extension in the Southern Mountains* (1898); *Christian Patriotism* (1913); *God's Plan for the Mountains* (1920); *For*

the Mountains, an Autobiography (1936).

Frost-bite, the effect produced upon any exposed part of the body by prolonged cold. A frost-bitten member becomes successively red, blue and white, and loses all sensation.

There are three degrees of frost-bite, just as of burns, namely, erythema, vesication and necrosis or death of the affected part. The latter is known as dry gangrene. The necrotic tissue or member (toe, finger, ear) drops off or may have to be amputated. Otherwise moist gangrene develops with danger of death from sepsis.

In milder cases, in which gangrene has not developed, symptoms subside in a few days leaving perhaps a residual hypersensitivity to cold, or pain which will respond to periarterial sympathectomy.

Treatment.—In the less severe cases gentle rubbing with snow or cold water will restore the circulation, after which more vigorous friction and gradually increasing temperatures may be applied. Good results have been obtained also by passive vascular exercise, Bier's congestive hyperemia, and tincture of benzoin. If suppuration develops hot antiseptic solutions are indicated. Sequestra must be excised. If amputation becomes necessary, this must not be undertaken until the line of demarcation is definitely indicated.

Prevention consists in keeping exposed parts warm and dry and avoiding cramped positions during undue exposure to cold. Trifling cases of frost-bite are termed chilblains (q. v.).

Frostburg, town, Maryland, in Allegany county, on the Cumberland and Pennsylvania, and the Western Maryland Railroads; 8 miles w. of Cumberland. It is situated at an altitude of 1,920 feet in a mountainous region. The mining and shipping of coal is the chief industry. The manufactures include iron castings, lumber, fire-brick, hosiery and tiles. It is visited as a summer resort. Pop. (1920) 6,017; (1930) 5,588.

Froth-fly. See Frog-Hopper.

Froth'ingham, Arthur Lincoln (1859–1923), American archæologist, was born in Boston. He studied at Rome and at Leipzig, making a specialty of Oriental languages and Christian archæology. He was fellow in Semitic languages and lecturer in archæology at Johns Hopkins University in 1882–6; in 1887 became professor of archæology and the history of art at Princeton, and in 1898 assumed charge also of the department of ancient history. He founded the *American Journal of Archæology* in 1885, and was the owner and editor of it until 1896. In 1895–6 he was associate director of the American School of Classical Studies at Rome. Among his publications are *Stephen Bar Sudaili, the Syrian Mystic and the Book of Hierotheos* (1886); (with A. Marquand) *A Text-Book of the History of Sculpture* (1896); *Monuments of Christian Rome* (1908); *Roman Cities in Italy and Dalmatia* (1910); *A History of Architecture* (1911).

Frothingham, Octavius Brooks (1822–95), American Unitarian clergyman, was born in Boston, Mass. He was graduated (1843) from Harvard, and entered the Unitarian ministry. From 1847 to 1855 was in charge of the North Church at Salem, Mass. He then resigned, having modified his views through the influence of Theodore Parker, and from 1855 to 1859 was minister of a liberal Unitarian church in Jersey City, N. J. In the latter year he resigned, and in 1860 formed and became pastor of the Third Congregational Unitarian Church in New York City, a congregation that, with its head, attained such radical views as to separate itself from any regular religious organization, taking as its name the 'First Independent Liberal Church of New York.' His principal works are his *Life of Theodore Parker* (1874), *A History of Transcendentalism in New England* (1876), and *A History of Boston Unitarianism from 1820 to 1850* (1890).

Frothingham, Richard (1812–80), American journalist and historian, was born in Charlestown, Mass. After serving as a member of the legislature of his native State for six terms (1839–50), he was mayor of Charlestown (1851–53). He was for many years the proprietor of the Boston *Post*, and was its managing editor from 1862 to 1865. His publications include *A History of Charlestown* (1848), *History of the Siege of Boston* (1849), *Life and Times of General Joseph Warren* (1865); *The Rise of the Republic of the United States* (1871).

Froude, frōōd, James Anthony (1818–94), English historian and man of letters, was born in Dartington, Devonshire. He was employed by Newman as one of the contributors to the *Lives of the Saints* series, which was intended to revive interest in mediæval Christianity. Froude, however, became a sceptic, and his heterodoxy became apparent when, in 1849, he published *The Nemesis of Faith*. In 1856 appeared the first two volumes of his *History of England from the Fall of Wolsey to the Defeat of the Spanish Armada*, a work which extended to twelve volumes and was concluded in 1870. Its main feature is the attempt to present Henry VIII in a new light. In 1860 he became editor of *Fraser's Magazine*. He visited the United States in 1872–73, where he delivered lectures on the relations between England and Ireland. In 1874 and 1875 he was in South Africa, and on his return he published, in 1880, *Two Lectures on South Africa*.

As a historian, Froude belongs to the literary, picturesque, and dramatic class. He has no sympathy with the scientific school, and is a follower of Carlyle in his belief in great men. His series of essays, published in four volumes under the title of *Short Studies on Great Subjects* (1867–83), display him at his best. On points of historic detail Froude is not exactly reliable; nor was impartiality one of his gifts. He edited *Carlyle's Reminiscences* (1881), *Mrs. Carlyle's Letters* (1883), and wrote the *Life of Carlyle* (1882), raising quite a storm by his unflattering portrait of Carlyle. Among the more important of his later works are his *Life and Letters of Erasmus* (1894), and his *Lectures on the Council of Trent* (1896), delivered as professor of modern history at Oxford from 1892; and Oceana (1886).

Fructidor, frük-tē-dōr', the twelfth month in the French calendar inaugurated at the Revolution.

Fructose, fruk'tōs, fruit sugar or levulose, $(HO.CH_2.CO(CH.OH)_3.CH_2.OH)$, occurs in fruit juices and honey together with dextrose, of which it is an isomer, with which it is also obtained on the inversion of cane sugar. It has been prepared synthetically, and is structurally a ketonic alcohol. It crystallizes as hard, anhydrous needles from alcohol and as prisms with ½ molecule of water from concentrated aqueous solutions. It rotates polarized light to the left, is fermentable by yeast, yielding the same products as does glucose, and reduces Fehling's solution. It is very slightly sweeter than cane sugar, and it is used as a sweetening agent in diabetes, being prepared on an industrial scale from dahlia tubers and from Jerusalem artichokes.

Fruit, a term used to denote the fertilized ovary of a flowering plant, and whatever structure may be incorporated with it. For the right understanding of any given fruit, a knowledge of the flower and of the

Fruit

process of fertilization, with its results, is necessary.

The gynœcium, or female system of a plant, is apocarpous or syncarpous according as the ovary consists of a single carpel united at its margins (and in this case there are many ovaries), or, of several carpels, which unite to form a single ovary, distinguished as plurilocular when the margins turn inward and divide it into compartments by walls or dissepiments, and as unilocular when the carpels cohere by their edges and do not turn inwards to form dissepiments. In the first case each separate carpel constitutes a distinct fruit; in the second the carpels are united to form a single fruit, and continue so until the product of their coalescence ripens and the seeds are dispersed. If an apple be cut transversely, the five locules containing seeds suggest that the pistil must have had five carpels, and examination of the apple blossom proves this to be the case. In the strawberry the fleshy receptacle is the popular 'fruit,' and the 'seeds' on the outside correspond, from a botanical point of view, to the core of the apple. Still greater complication may be seen in the fig, where the fleshy part is the receptacle, and the 'seeds' in the interior are the ripened ovaries of the pistillate flowers.

The part of the fruit covering the seeds, whether consisting of the carpels alone or with the receptacle superadded, is called the pericarp, or fruit-wall. Sometimes this is divided into distinct layers—which are called endocarp, mesocarp, and exocarp—from within outwards. The character of the ripe pericarp has been used as a criterion in distinguishing the different varieties of fruits. The classification generally accepted as simplest recognizes two great groups of fruits—dry and succulent.

Dry Fruits.—Dry fruits are those having a woody or leathery pericarp, the cell-sap having disappeared. There are two classes of dry fruits, indehiscent and dehiscent. The indehiscent fruits are those in which the pericarp does not split open but continues to enclose the seed until the covering wears away or is burst open by the germinating embryo. Common examples are the hazel nut; the fruit of the family *Compositæ*, as the thistles and sunflowers; and the fruit of various grasses, as rice, wheat, barley, and maize. Dehiscent fruits, often called capsules or pods, are those in which, when the fruit is perfectly ripe, the pericarp splits to allow the escape of the seeds, which are themselves enclosed in a tough testa. The method of dehiscence varies. Capsules consisting of an aggregation of carpels may separate when ripe, by slits at the dissepiments (*septicidal dehiscence*), as in the gentian, or along the midribs (*loculicidal dehiscence*), as in the violet; or the seeds may escape through pores, as in the poppy. The follicle, the simplest form of capsule, consisting of a single carpel, dehisces by the ventral suture, as in the peony; the legume, another simple form, has two lines of dehiscence or sutures, exemplified in peas and beans. The silique, consisting of two carpels, divides along a middle partition, as the shepherd's purse; the pyxidium, opens by a lidlike valve, as the pimpernel.

Succulent Fruits.—Succulent fruits are those in which the tissue of the pericarp, or certain layers of it, remain succulent until the fruit is ripe. The majority of succulent fruits are indehiscent but some few are dehiscent, as the horse-chestnut, the walnut, and the banana. There are two main classes of indehiscent succulent fruits, the drupe or stone-fruit and the berry. In the drupes, examples of which are the plum, cherry, and peach, a mesocarp of fleshy texture lies within a thin epicarp; the endocarp forms a hard thick layer which usually encloses one seed. In the berry the tissue of the pericarp forms a succulent pulp within a more or less hard epicarp, the seeds being embedded in the pulp and surrounded by a firm testa. The berry usually contains more than one seed, as in the grape, currant, or tomato, but sometimes only one occurs, as in the date. The various species of *Citrus*, often called *Hesperidium*, closely resemble the berry and may be classed with it. Some few of the more familiar forms of fruit cannot properly be placed in either of the above classes, as the strawberry, which consists of a pulpy receptacle in which many small achenes (pits) are embedded, and the pineapple, whose entire inflorescence is a mass of edible pulp.

Food Value of Fruits.—In fresh ripe fruits the percentage of water varies from about 78 to 85, being as high as 95 in the watermelon. There is a fair percentage of carbohydrates, chiefly sugar and starches, a small proportion of protein and mineral salts, and a valuable amount of vitamines B and C. It is chiefly these vitamines and the mineral salts which make fruits a desirable addition to the diet.

The proportion of insoluble residue—skin and cellulose, stone and seed—obviously varies greatly with succulence and ripeness, but may be taken, one fruit with another, at not less than from 4 to 6 per cent., rising as high as 30 per cent. in some fruits. Unripe fruits may contain a notable proportion of starch; but this is fermented, on ripening, into glucose and other sugars, fruit sugar, grape sugar, cane sugar, or (in *Sorbus*) sorbin. The only fruits which retain starch in important quantity are the banana, breadfruit, and baobab; hence the exceptional nutritive value of these. The olive alone yields a notable proportion of oil. The proportion of sugars varies exceedingly—dates, dry figs (48 per cent.), and raisins (56 per cent.) heading the list. An important carbohydrate constituent of fruit, to which is due its jelly-making property, is pectin, especially abundant in unripe fruit. Most fruits contain only a negligible quantity of fat.

Dried or evaporated fruits contain all the nutritive value of the fresh article except the vitamines and are desirable on the score of economy and convenience. See *Fruit Preservation*, below.

In general it may be said that fruits form a wholesome and palatable addition to the diet. Fresh fruits are dilute foods closely resembling green vegetables in nutritive value, but dried and preserved fruits are more concentrated and compare favorably with cereals and dry vegetables in amount of nutriment. The carbohydrates in fruits excellently supplement foods richer in proteins, such as meat, fish, and dairy products, while the mineral matter supplies the iron and other mineral constituents essential to good health. Their effect is often good in stimulating sluggish intestines, and their digestibility compares favorably with other common foods.

Fruit Growing.—Production of fruit, unlike that of general farm crops, demands a high degree of specialization. Because fruit plants are peculiarly subject to the vagaries of climate and soil and subject also to an unusual number of insect and fungous pests, the successful grower must have a thorough knowledge of the technical aspects of the business. As a result of this specialization fruit growing on a home orchard basis is decreasing. In the United States, the centers of commercial fruit growing are restricted to the more favored regions. Citrus is produced along the southern border of Florida, California, Arizona, and Texas. Apple growing is concentrated in the Pacific Northwest, Central and North Atlantic States. The

peach is more cosmopolitan in requirements with centers in Georgia, Texas, the Carolinas, New Jersey, New York, Michigan, Illinois, Indiana, and California. The pear is grown extensively in the Pacific Coast States, in Michigan and New York. The strawberry grows well over a wide area, production moving with the season from Florida and Louisiana to the Canadian line. Grapes are divided into two major types, the vinifera in California and the labrusca, such as Concord and Niagara, in the north central and northeastern States.

Science has greatly aided the fruit grower in the development of improved varieties, controlling of pests, providing knowledge as to pollination requirements and in uncovering the underlying principles of soil management, pruning and the handling of the harvested product. The fact that many varieties of apple, pear, plum and cherry require cross pollination was demonstrated by careful study and proper combinations of varieties suggested. The manner of spread of diseases such as fire blight and scab of the pear and apple was discovered and means of prevention suggested. The inhibitory effects of severe pruning on growth and fruiting was proved. Modern fruit growing owes its stability and success to the cooperation of the research worker and to the intelligent orchardists who have adopted his suggestions.

Pollination.—An important secret of date pollination was discovered by plant physiologists of the United States Department of Agriculture in 1931. This discovery enables date growers to hasten or delay the maturity of their crop, so as to have it ripen when weather conditions are most favorable.

The secret, discovered by Dr. W. T. Swingle and R. W. Nixon of the Bureau of Plant Industry, is that pollen from certain male date trees when placed on flowers of female trees influences the size of the fruit produced and its time of ripening. The effects of cross-pollination in most plants do not usually appear until the seed develops and bears fruit. This hitherto unknown effect of pollen on the tissues of the mother plant has been given the name *metaxenia* (ectogony), and since the first report of its occurrence in dates it has proved to occur in cotton and apparently in a few varieties of apples.

This discovery promises to revolutionize date culture in some of the important date-growing regions of the United States, since pollen from some male trees causes early maturity of the fruit, while that from other trees causes late maturity. All date trees must be pollinated by hand, so the practical application of this discovery entails no extra work or expense.

Spraying.—In certain areas, such as the irrigated sections of the Northwest, eight or more sprayings are required to carry apple crops through to maturity in satisfactory condition. The usual program includes a winter spray of lime sulfur or of oil for insects such as the San Jose scale followed by a succession of sprays during the growing season for fungi and for the codling moth. Research workers in the agricultural experiment stations have worked with the growers in developing effective materials and in timing their applications. Manufacturers have played an important part by devising effective equipment for applying sprays. Recently stationary spraying plants have come into the picture, for expediting applications and for orchards on rough terrain where movable outfits are at a disadvantage.

Spray residues, resulting from arsenical, lead and fluorine sprays and dusts are a serious problem especially in regions of little rainfall. Legal tolerances for these toxic materials were met by washing the fruits in dilute acid or alkaline solution. Here again the research workers aided the growers by devising effective methods of washing followed by proper rinsing in clear water. Apples and other fruits are not impaired in keeping quality or appearance by washing and in some cases are actually improved in market quality.

Handling and Marketing.—The preparation of fruit for market begins in the orchard in the good care of the trees and in effective spraying programs. Washing to remove excess spray residues where present is an essential step in marketing. Time of picking is an important factor especially with fruit designed for storage and long shipment since fruit picked too immature fails to attain full quality and overmature fruit, on the other hand, fails to keep satisfactorily. As a measure of maturity, many growers use a penetrometer, devised to measure the pressure required to push a plunger a given distance into the fruit. Size, color and ease of separation from the tree are also useful indexes to maturity.

Practically all the citrus crop and much of the pear and apple crop that moves to distant markets is handled in boxes of standard sizes. The better grades of fruits are sorted carefully for size and freedom from injury and wrapped individually in tissues often bearing the name of the producer or packing organization. In the central and eastern States the bulk of the apple crop is marketed in bushel baskets. Barrels are still used to a considerable extent for eastern apples particularly those designed for export trade. With unwrapped apples shredded paraffined paper is often scattered among the fruits to decrease storage losses. Peaches, plums, cherries, apricots and grapes from the Pacific coast States are sold largely in shallow crates. The eastern peach crop moves to market in splint bushel and half bushel baskets. Berries are handled in quart or pint baskets which are packed into larger crates. Eastern grapes are packed largely in Climax splint baskets of different sizes.

Motor trucks play an important part in the movement of perishable fruit competing with the railroads not only in short hauls but in journeys of several hundred miles.

The refrigerated car has made possible the successful transportation of quickly perishable fruits and melons across the continent irrespective of the time of year.

Precooling of the fruits prior to loading in the car is employed to hasten cooling and to save ice during transit. Precooling makes possible the shipment of riper, higher quality products.

Perhaps the outstanding feature in the marketing of fruit has been the successful development of large co-operative organizations. These have been of great significance in the handling of fruit destined for transcontinental shipment. The California Fruit Growers Exchange is a striking example of the success of co-operative movement, handling in certain seasons 75% or more of the entire shipments of citrus from California and Arizona. In addition to selling service, these organizations often play an important role in purchasing supplies such as crates, fertilizers and spraying materials. Most important of all, the co-operatives avoid gluts of fruit in certain markets by judiciously distributing the cars and by extensive advertising to stimulate consumer utilization.

Fruit Preservation.—Of the various ways of preserving fruit, namely, drying, canning and quick freezing the last is the most recent development. Quick freezing preserves the color, flavor and form of the fruit and the resulting product upon thawing is almost equal to fresh fruit. Freezing plants have been estab-

lished in commercial growing centers and the product distributed in the frozen state to various urban points where it is retailed to the consumer. Fruits are usually frozen in a sugar syrup which helps retain color and quality. Literally hundreds of tons of strawberries and raspberries are frozen in the Pacific Northwest for shipment to the eastern states.

Drying is an important means of preserving fruit and is accomplished naturally by the sun and artificially in evaporaters. Dried fruits have the advantage of decreased weight and concentration of the nutrients. Despite the developments in quick freezing there is no question but that drying will always be an important factor in fruit preservation as will also the usual method of canning in tinned receptacles.

Considerable interest has been displayed of late years by British and American research workers in the storage of fruits in an atmosphere of increased carbon dioxide. The life of the fruit is prolonged by the slowing down of respiration and other maturity processes. The carbon dioxide treatment is still in the experimental stage with indication that it may find an important place in fruit preservation, particularly as an adjunct to cold storage.

Food Value of Fruits.—Although fruits in general cannot be considered staple foods in the same sense as the grains and certain vegetables such as the Irish and sweet potatoes they are nevertheless an important component of the diet and are universally esteemed. Fresh ripe fruits contain high percentages of water in which are dissolved sugars, minerals and aromatic constituents that make for flavor and palatability. Certain of the fruits are valuable sources of vitamins, particularly of C, the antiscorbutic vitamin. Citrus fruits and the tomato are recognized as particularly valuable sources of vitamin C. Recent investigations show that varieties within a species may differ profoundly in their vitamin C content; for example, the Maine Agricultural Experiment Station found that the Baldwin apple is a good source of C whereas the McIntosh apple is relatively low. The Massachusetts Experiment Station reported a similar situation in the tomato. The relatively inert portions of the fruit such as the skin, the cell walls and the fibers are valuable additions to the bulky portion of the diet.

Fruits are not only valuable in the fresh and dried state but are extensively used in the manufacture of nourishing fermented and unfermented drinks, ice creams, sherbets, pastries and many other articles of food. The use of citrus and tomato juices has expanded tremendously in recent years as a result of studies showing their high food and health values. Certain of the tropical fruits such as the banana, date, fig, breadfruit, papaya and avocado have primary food value. Millions of dollars worth of bananas are imported each year into the United States and form an important feature of the diet in many homes. Dried fruits such as the date, fig, raisin and prune are important commodities in the world's trade. The avocado, unlike most fruits, contains a considerable percentage of oil, as much as 18% in certain varieties. It is becoming increasingly popular as a salad fruit. On the whole fruits form a wholesome and desirable addition to the human diet, their beneficial effects on health far exceeding, in many cases, their actual food content.

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Fruit Bat, a name given to all members of the family Pteropodidæ, also called flying foxes or fox bats, from the fox-like heads of the more typical forms. The members of this family are the largest of the bats and by some naturalists are considered to form a sub-order known as *Megachiroptera*. The index finger of the hand has three segments, instead of one or two as in the insect-eating bats, and is usually furnished with a claw; the ears are of small size; the tail, if present, is always short, and is placed beneath the membrane which connects the hind limbs; the stomach is more complex than in the insect-eating bats; the cheek teeth are not cusped, but have their crowns elongated and grooved, so as to fit them for the work of masticating fruit. All the fruit bats are confined to the warm countries of the Old World. To the genus Pteropus ('wing-foot') belong the fruit or fox bats of India, the islands of the Pacific and Indian Oceans, and Australia. The largest species, *P. edulis,* native to the Malay Archipelago, measures five feet from tip to tip of the wings and is eaten by the natives. The Indian form (*P. medius*) sometimes assembles in vast flocks, and commits serious depredations in plantations. Other species are the short-nosed fruit bat of India (*Cynopterus marginatus*) and the tiny long-tongued fruit bat (*Carponycteris minima*) of the same region.

Fruit Pigeons (*Carpophaga*), a genus of pigeons, including about fifty species, distributed throughout Australian and Oriental regions, but much more abundant in the former. They live in forests, are well adapted for arboreal life, and feed on fruits. The gape is wide; the plumage brilliant. See PIGEON.

Fruit Sugar. See FRUCTOSE.

Frumentius, Saint, froo̅-men'shi-us, apostle of Ethiopia and the Abyssinians, was born in Phœnicia toward the beginning of the fourth century. He and another youth, named Ædesius, were captured on the shores of Abyssinia, and taken as slaves into the service of the king, where they made themselves so beloved that Ædesius was raised to the office of cup bearer, while Frumentius became the king's private secretary and instructor to the young prince. He gradually paved the way for the formal introduction of Christianity. In 326 he went to Alexandria, and was by Athanasius consecrated bishop of Axum. The new bishop returned to Abyssinia, and succeeded in proselytizing large numbers. He is supposed to have translated the Bible into Ethiopian. He died about 360.

Frundsberg, froo̅nts'berch, GEORG VON (1473–1528), leader of the Landsknechte (German free-lances) under Maximilian and Charles V, was born in Mindelheim, Swabia. Taking an important part in the wars in Italy and the Netherlands, he led his troops in twenty engagements, and was the hero of many valiant exploits, especially at Bicocca, near Milan (1522), and at Pavia (1525), when, with 1,800 men, he stormed a well-nigh impregnable pass, guarded by 9,000 Venetians, whom he captured.

Frus'tum, in geometry, is the part of a solid next the base, left on cutting off the top by a plane parallel to the base. The frustum of a sphere or spheroid is any part of these solids comprised between two circular sections.

Fry, SIR EDWARD (1827–1918), English jurist, was born in Bristol and educated in Lon-

don. He became judge of High Court, Chancery division (1877), and was a lord justice of appeal (1883–92). He served on many commissions, including the Paris North Sea Inquiry Commission (1905). His international fame is based on his arbitratorship between the United States and Mexico in the Pious Funds case (1902), that between France and Germany on the Casablanca incident (1909), and on his office as first British plenipotentiary to The Hague Peace Conference (1907). He wrote *A Treatise on the Specific Performance of Public Contracts* (1858).

Fry, ELIZABETH (1780–1845), English philanthropist, third daughter of John Gurney of Earlham Hall, was born in Norwich. When eighteen years old she became a 'plain Friend' and from that time worked much among the poor, founding a school for poor children, which she managed entirely herself. In 1800 she married Joseph Fry, of Plashet, Essex, then engaged in extensive business with his brother in London. In 1810 she became a preacher among the Friends. After visiting Newgate in 1813, and introducing many improvements for the women, prison reform became the one great object of her life. She visited prisons in different parts of Great Britain and the Continent, and brought about many improvements in their management and discipline. Through her influence libraries were begun in the naval hospitals and the coast guard stations, and Bibles were supplied to them. Consult G. King Lewis, *Elizabeth Fry* (1910).

Fry, JAMES BARNET (1827–1894), American soldier, was born in Carrollton, Ill., and was graduated from the U. S. Military Academy (1847). He served in Mexico (1847–8); was twice instructor at West Point; and held several frontier and garrison posts. He was made assistant adjutant general in March, 1861, and took part in the Battles of Bull Run, Shiloh, and Corinth. He became provost marshal general (March, 1863), and was engaged, until the abolition of that post (1866), in organizing enlistment. In this office he was charged with corruption by Congressman Roscoe Conkling, but the accusations were not sustained. He served as adjutant general with the rank of colonel in several divisions of the South and West (1866–81), until he retired. He had been brevetted major general March, 1865. His publications include *Operations of the Army Under Buell* (1884); *McDowell and Tyler in the Campaign of Bull Run* (1884); *New York Under Conscription* (1885); *The Conkling and Blaine-Fry Controversy in 1866* (1893).

Fry, JOSEPH (*c.* 1828–73), American filibuster, was born in Louisiana. He entered the United States Navy as a midshipman (1841); was promoted lieutenant (1855), but in 1861 resigned, and entered the Confederate Army. In 1873 he was captain of the filibustering steamer *Virginius;* was captured on the high seas off Jamaica by the Spanish man-of-war *Tornado;* and with fifty-six of his crew was shot as a pirate. See VIRGINIUS AFFAIR.

Fry, WILLIAM HENRY (1813–64), American composer and critic, was born in Philadelphia. He studied music in Philadelphia and in Germany. In 1839 he joined the staff of his father's paper, *The National Gazette,* and in later life was editor of the Philadelphia *Ledger,* and wrote for the New York *Sun, Tribune,* and other papers. He was best known, however, as a musical composer and lecturer. His productions include the operas *Leonora* (1845) and *Notre Dame de Paris* (1863), and the symphonies *The Breaking Heart, A Day in the Country, Santa Claus,* and *Childe Harold.*

Fryatt, CHARLES (1872–1916), British seaman, was captain of the Great Eastern packet *Brussels,* plying between Tilbury and the Hook of Holland. In March, 1916, during the World War, he was ordered to stop by a German submarine. He refused to do so and skilfully evaded capture. On June 22, a flotilla of German destroyers captured his ship. He was charged with attempting to ram a submarine and, after a secret trial, was shot in Bruges, Belgium, July 27. Half an hour later a telegram was received postponing the execution. After the Armistice Fryatt's body was exhumed and brought to London, where a striking memorial service was held in St. Paul's Cathedral, July 8, 1919. His ship, which had been held at Zeebrugge, was returned by the Belgians to the British in 1920.

Frye, WILLIAM PIERCE (1831–1911), American legislator, was born in Lewiston, Me., and educated at Bowdoin College. He studied law under W. P. Fessenden, and practiced in Rockland, Me. He was a member of the State legislature (1861–2, 1866–7); a Lincoln Presidential elector (1864); attorney general of the State (1867–70); and a Representative in Congress (1871–81); U. S. Senator, in succession to James G. Blaine (1881), and during his thirty years of continuous service devoted himself to the question of the Geneva award, to commercial legislation, and to the fisheries disputes. He was president of the Senate (1896–1911). His greatest work as a legislator was done as chairman of the Committee on Commerce, and as member of the Committee on Foreign Relations. He advocated a strong merchant marine.

Fryer, DOUGLAS HENRY (1891–), American psychologist, was born at Willimantic, Conn., and was educated at Springfield, Mass., College, Clark University and Columbia. After teaching in New York University he became (1925) administrative chairman of the department of psychology at University College. During the World War he served in the U. S. Army and the Am. Red Cross. He wrote *Vocational Self Guidance, Planning Your Life Work* (1925); *Outline of General Psychology* (1935).

Frying. See COOKERY.

Fryxell, früks'el ANDERS (1795–1881). Swedish historian, was ordained to the ministry and in 1821 became *magister philosophus* at the University of Upsala. In 1828 he was made rector of the Stockholm Gymnasium, and from 1835 to 1847 pastor of Sunna in Vermland. In 1840 he was elected member of the Swedish Academy, and from 1847 until his death devoted himself to historical research. His published works include *Handlingar rörande Sveriges historia* (1836–43), and his principal work, *Berättelser ur Svenska historien,* in 46 volumes (1832–79), a narrative history of Sweden from the earliest times to the death of Gustavus III. These narratives, largely biographical in form, and distinguished by their impartial love of truth, soon obtained a wide popularity in Sweden. He is also the author of the first systematic grammar of the Swedish language.

Fuad I (AHMED FUAD PASHA) (1868–1936), king of Egypt, son of Ismail Pasha, was born in the palace of Gizeh. He spent his youth in Italy, returning to Egypt in the nineties and becoming aide-de-camp to Khedive Abbas Hilmi II. On the death of his elder brother in 1917, he became Sultan and on the termination of the British Protectorate in Egypt in 1922, was proclaimed King of Egypt, becoming the ninth ruler of the dynasty of Muhammed Ali, who was appointed governor in Egypt in 1805. He was an astute and progressive ruler who exerted himself to modernize his country.

He was succeeded by his son, Faruk I (1920–).

Fuad Pasha, fōō'ad pä'shä, MEHMED (1814–69), Turkish statesman and *littérateur*, was born in Constantinople. He studied medicine, and for some years was Admiralty physician, but in 1835 forsook medicine, and employed himself in the study of diplomacy, history, modern languages, the rights of nations, and political economy. In 1840 he became first secretary to the Turkish embassy at London, and in 1843 was at Madrid. On his return to Constantinople he was appointed to discharge the functions of grand interpreter to the Porte, and in 1852 and again in 1867 was minister of foreign affairs. He received the title of Pasha (1855), in 1861 held the office of Grand Vizier, and in 1862 was minister of finance. He was a member of the Turkish Academy of Science and Belles-Lettres.

Fuca, fōō'kä, JUAN DE, or APOSTOLOS VALERIANOS (?–1602) Greek mariner of the sixteenth century, was born in Cephalonia. According to *Purchas his Pilgrimmes* (1625), he discovered the strait which bears his name, and navigated it for twenty days. The story is probably a fabrication, but Fuca was a real personage, who served in the East Indies as a pilot under Spain. In 1506 he tried to obtain admission into the English service.

Fuca, or JUAN DE FUCA, STRAIT, a passage separating Washington State from Vancouver Island, and connecting the Pacific Ocean with the Gulf of Georgia. It contains several islands, one of which, San Juan, became the subject of a dispute between Great Britain and the United States, the question being whether it was to be regarded as an appendage of Washington Territory or of British Columbia. In 1872 the Emperor of Germany, as arbiter, decided that the line of boundary should be run through the Strait of Haro, west of San Juan, thus awarding that island to the United States; and it, with several neighboring islands, now forms the county of San Juan, Washington, with a pop. (1930) of 3,097.

Fucaceæ, fōō-kā'ce-e, a term in botany applied to a small class of large brown seaweeds with branching fronds sometimes provided with air bladders. See SEAWEED.

Fucecchio, fōō-chāk'kē-ō, commune, Italy, in the province of Florence, on the Arno; 23 miles west of Florence. Pop. 13,000.

Fu-chau, city, Fu-kien, China. See FOOCHAU.

Fu-chien. See FU-KIEN.

Fu-chow, town, in Manchuria, Liao-tung province, on the Gulf of Liao-tung; 75 miles southwest of Newchwang. Pop. 10,000.

Fuchs, fōōks, JOHANN NEPOMUK VON (1774–1856), German chemist and mineralogist, was born in Mattenzell, Bavaria. He was educated at Freiberg University and in Paris, and in 1807 became professor of chemistry and mineralogy at Landshut. In 1826 he occupied the chair of mineralogy at the University of Munich. Besides important researches in the subjects mentioned, he is remembered for his discovery of the process of stereochromy, a process for the preservation of frescoes by the application of soluble glass to their surfaces.

Fuchs, LEONHARD (1501–66), German botanist, was born in Wembdingen, Bavaria. After becoming a convert to Protestantism, he accepted a medical professorship at Tübingen (1535). His botanical researches were summed up in his beautifully illustrated *Historia Stirpium*, (1542), a description of all the plants indigenous to Germany. He also formulated a botanical nomenclature.

Fuchsia, fū'sha, a genus of flowering plants of the natural order Onagraceæ, containing about seventy species. They are generally small shrubs or trees, natives of the Pacific Coast of South America, whence a few have ranged northward to Central America, and others to New Zealand. The flowers are tubular, with four spreading calyx lobes, four or five petals, and long, exserted pistil and stamens. They are usually drooping from the axils of the glossy foliage, and are found in many short or long tubed forms, and in various combinations of red, purple, and white lines. They are favorite house plants, especially adapted to shady places, and are easily raised from cuttings and in mild climates make excellent outdoor shrubs. The florists' varieties and hybrids are innumerable, many having been derived from the species *F. macrostemma* (*F. magellanica*), *F. coccinea*, *F. speciosa*, *F. fulgens*, and *F. procumbens*. The berries of many species are eaten with sugar in their native countries.

Fuchsine, MAGENTA, or ANILINE RED, is a salt, usually the chloride, of rosaniline, which is triamidotolyl-diphenyl carbinol—HOC $(C_6H_3CH_3NH_2)$ $(C_6H_4NH_2)$. It is prepared by oxidizing a mixture of aniline and toluidine by nitrobenzene, extracting with dilute hydrochloric acid, and recrystallizing from brine. Fuchsine forms red crystals with a green lustre, that are sparingly soluble in water, but easily in alcohol. It dyes wool and silk directly, and cotton with a mordant; but the color, though brilliant, is fugitive, hence it is little used for dying at the present time. The greater part of the fuchsine produced is used for the preparation of alcohol and water-soluble blue dyes by phenylation and sulphonation.

Fucino, fōō-chē'nō, LAKE OF, or LAGO DI CELANO, former lake of Italy, in the province of Aquila; 60 miles east of Rome. Being only 75 feet deep and having no constant outflow, it was subject to sudden risings. To obviate this danger the Emperor Claudius in 44–52 A.D. cut a subterranean channel, nearly 3 miles in length. This tunnel, however, soon became obstructed, and long remained so. As the lake had been steadily rising since 1783, it was drained in 1854–75, and is now under cultivation. Its area is 40,000 acres.

Fucoid, a term applied either to a seaweed belonging to the Fucaceæ, or a plant resembling such a seaweed.

Fucus, fū'kus, the generic name of various species of brown seaweed which form the main vegetation of rocky shores between tide marks. Commonest of all is *F. vesiculosus* (Rockweed, Bladderweed, sea wave, and the like), easily distinguished by its

Fucus

entire edges and paired air vesicles. On account of the large proportion of ash it forms a valuable manure. Besides manure, the only direct chemical utilization of the fuci is for the preparation of iodine. (See KELP.)

The vegetative body of fucus is usually a thallus; the branch-

ing is dichotomous in one plane. Of the inner or medullary cells of the thallus, the outer wall becomes mucilaginous, while the less superficial of the rind cells develop filaments which grow inward, thus surrounding the inner cells within a network of filaments. The ladders are formed by the simple separation of portions of the tissue, the cavities becoming distended by air. Fertilization takes place when the ripe fertile fronds are left bare by the tide. The fertilized ovum soon develops a wall, becomes attached, and proceeds to divide and lengthen, forming a root-like attachment at one end, a growing point at the other. See SEAWEEDS.

Fuegians, fū-ē'ji-anz, the aborigines of Tierra del Fuego, of whom there are three distinct groups—the Onas in the east, the Yahgans in the centre, and the Alacalufs in the west. The *Onas* appear to belong to the same stock as the Tehuelche Patagonians, whom they resemble in their tall stature, nomad life, and speech. Of the *Alacalufs* little is known, but that little points to their descent from the Araucanians. The true aborigines are the *Yahgans*, whose physical characters, especially their low stature and distinctly dolichocephalous (long) skulls, ally them to the Botocudos and other primitive long-headed races of the New World. They speak an independent stock language which has been reduced to written form, and into which some parts of the Bible have been translated.

Fuego, Tierra del. See TIERRA DEL FUEGO.

Fuel Briquettes, popularly referred to as "packaged fuel," are made by compressing split or low-grade coal into slow-burning bricks of convenient size and shape. The manufacture and distribution of briquettes constitute a considerable industry in many countries, particularly in those which have a large supply of low-grade coal. Production figures for 1937 showed the following amounts for the countries most active in this industry; the United States, 1,036,000 metric tons; Belgium, 1,849,000 tons; Germany, 48,727,000 tons; France, 7,957,000 tons; Netherlands, 1,327,000 tons; Czecho-Slovakia, 724,000 tons. The total production for the world was computed to be about 64,261,000 tons. In Europe briquettes were an important factor in export trade, Germany and France leading the way. The United States consumed nearly all the briquettes which it produced, distribution in 1937 being confined to 36 states, Alaska, and Canada. The United States also distributed 132,400 short tons of paper-wrapped briquettes.

Fuels, substances which may be burned by means of atmospheric air with sufficient rapidity to evolve heat capable of being applied for economic services.

Fuels are essentially hydrocarbonaceous substances, of organic origin, their value depending upon the amount of carbon and hydrogen—the essential heat-producing elements—which they contain. The majority of fuels contain also oxygen, nitrogen, sulphur, and phosphorus, together with a certain proportion of inorganic material which constitutes the ash. From a practical point of view, the chief value of a fuel is its capability of giving out heat during combustion. This heating capability (generally known as the calorific power) is the quantity of heat—measured in heat units—generated by the combustion of a unit weight, and is usually expressed in British thermal units per pound, calories per kilogram, etc. The heating power of a fuel is also expressed in evaporation units—*i.e.*, by the number of pounds of water evaporated from and at 212° F. per pound of fuel, if all the heat were transferred to the water without loss.

Fuels may be conveniently classified as *Solid*, *Liquid*, and *Gaseous*. The principal solid fuels are coal, wood, peat, coke, and charcoal. Petroleum and vegetable and animal oils are the liquid fuels most in use, with alcohols possibly included. For special uses, chemical derivatives, like amyl-acetate, are employed. Coal gas, water gas, natural gas, and producer gas are the chief gaseous fuels.

(1) SOLID FUELS.— COAL.— Economically coals are by far the most important of the fuels. An old familiar classification of coal is as follows: (1) Anthracite. (2) Bituminous—(*a*) anthracitic coal; (*b*) coking and furnace coal; (*c*) gas coal; (*d*) non-coking, long-flame coal. (3) Lignite, or brown coal. (4) Cannel coal.

Anthracite consists largely of free carbon, up to 98 per cent. of the total combustible constituents. It is difficult to ignite, but yields an intense local heat, and burns without flame or smoke. (See ANTHRACITE.)

Anthracitic or slightly bituminous coal contains from 90 to 93 per cent. of free carbon in the total combustible. It is somewhat difficult to ignite, and if dry there is not much tendency to smoke. It does not coke, and is excellent for steam raising.

Coking and Furnace Coal contains from 85 to 91 per cent. of free carbon in the combustible. It burns with a more or less luminous, smoky flame; and some contains as much as 30 per cent. of volatile hydrocarbon. On heating, this class of coal softens and swells up, forming a dense, coherent coke, whose weight varies from 50 to 80 per cent. of the weight of the original coal. It is much used for general furnace purposes, and for making coke.

Gas Coal contains from 80 to 85 per cent. of free carbon in the combustible; it yields a large amount of gas, and burns with a long, luminous flame.

Non-Coking, Long-Flame Coal contains from 75 to 80 per cent. of free carbon in the combustible; the available hydrogen being low, the calorific power is also low. It burns with a long smoky flame, and yields on distillation large quantities of tarry matter. It gives a clean fire, high temperature, and is a good general fuel.

Lignite contains from 60 to 75 per cent. of free carbon in the combustible; but is not of great present value as fuel because of its moisture content. (See LIGNITES; BROWN COAL.)

Cannel Coal is so called from the fact that it burns with a flame like that of a candle.

In the United States, the older classifications of coal have been generally superseded by the following: (1) anthracite, (2) semi-anthracite, (3) semi-bituminous, (4) bituminous, (5) sub-bituminous, (6) lignite. See COAL.

Analysis of Typical American Coals

	Moisture.	Volatile Combustible.	Fixed Carbon.	Ash.	B. T. U. per. lb.
Pennsylvania Grate Anthracite	3.34	4.74	81.08	10.84	12,717
Arkansas Semi-Anthracite	1.28	12.82	73.69	12.21	13,406
New River (W. Va.) Semi-Bituminous	1.65	22.30	71.93	4.13	14,718
Connellsville Bituminous (coking)	0.97	19.09	60.85	9.09	13,951
Illinois Bituminous (non-coking)	8.80	43.05	39.43	8.72	12,673
Wyoming Sub-Bituminous	8.68	43.41	46.49	3.52	11,620
Texas Lignite	8.88	36.17	43.65	10.30	10,288

PEAT.—When fresh from the bog, peat (q.v.) may show a moisture content up to 90 per cent.; and on account of its absorption by the cellular matter, not much of this moisture can be pressed out. When air-dried, peat retains permanently about

20 per cent. of moisture; when kiln dried, about 7 per cent. Various machines and processes have been devised for removing, drying, and briquetting the bog peat. The difficulty with most of these is the high cost. The heat required for machine dryers usually consumes most of the fuel produced. In some successful modern plants, the peat blocks are sun dried on pallets, like brick. In others, the top of the bog is loosened up, and the harrowed peat spread out to dry; being later swept up mechanically, and worked into briquettes of powdered fuel for local use.

Coke and Charcoal.—These are carbonized fuels obtained by heating coal and wood to redness in a closed vessel, or retort, in order to distil off the volatile constituents. See Coke; Charcoal.

Wood.—Newly felled wood contains from 30 to 50 per cent. of moisture. Air-dried (one year) wood contains from 10 to 20 per cent. of moisture, 40–50 per cent. of carbon, 4–8 per cent. of hydrogen, 35–40 per cent. of oxygen, and from 2 to 3 per cent. of ash. The calorific power of wood is low, because it contains but little available hydrogen. For American woods, the calorific power ranges from 6,600 B.T.U. per lb. for dried white oak to 9,880 for dried long-leaf pine. For fuel purposes, it is commonly assumed that 2¼ lbs. of dry wood is equal to 1 lb. of bituminous coal.

(2) Liquid Fuels.—Petroleum and petroleum refuse, tar and tar refuse, have a much higher calorific power than coal. Crude petroleum consists of about 85 per cent. of carbon and 15 per cent. of hydrogen. For the same heat content the volumes of coal and crude petroleum are about as 30 to 20, while the weights are about as 27 to 20. Liquid fuel gives special facilities for the development and maintenance of an intense, steady heat, prompt lighting and extinguishing of the fire, and great ease of regulation and perfect combustion. Crude petroleum can be obtained in some localities at a price which compares favorably with coal; it is being much used for steam-raising purposes on locomotives and in steamships. The great demand for gasoline for automobiles, however, is causing a steady and general decrease in the use of crude oils, though the heavier derivatives are still available for firing.

To burn liquid fuels in a furnace it is necessary to spray the fuel into a combustion chamber. The minuteness of the particles and the size and shape of the furnace have great influence on the efficiency of combustion. The flame must be distributed evenly without overheating any of the absorbing surfaces, and the vapor must be burned completely before it is chilled. With the best steam atomizers it is possible to secure a spray so fine and combustion so complete that the furnace is filled with clear, invisible gas; but such complete atomization is expensive on account of the excessive amount of steam required.

Fuel oil burners are of three general classes: (1) Mechanical sprayers, in which the oil under pressure is forced through nozzles that give high tangential velocity on exit; (2) carbureting burners, which largely vaporize the oil before its exit into the combustion chamber; and (3) steam or compressed air sprayers. The last are divided into outside and inside mixers, according as the steam or air is mingled with the oil before or after it leaves the final orifice.

Steam is more widely used for spraying than air on the score of simplicity; an average value of the amount required would be 0.5 lb. per lb. of oil. Vaporizing burners have lower capacity than spraying burners, and are not as suitable for steam boilers which are to be forced at times. For marine use, steam spraying wastes too much fresh water, and air compressors are too cumbersome, so that mechanical atomizers are favored. Probably the best results are secured when the oil is forced to take a whirling motion inside the burner, so that the particles fly off tangentially on exit. It has been proposed (Koerting patent of 1905) to superheat the oil, so that on leaving the burner it flashes into vapor; but this plan is dangerous, and without any practical gain.

A coal-fired boiler that absorbs 80 per cent. of the heat in the fuel is unusual, and 70 per cent. is a good average result. With oil fuel, however, the combustion can be made more complete without great excess of air, due to atomization. The result is that 80 per cent. efficiency is often exceeded, while 75 per cent. is a good average. Tests in 1912 of a 450 horse power oil-fired water-tube boiler in the U. S. Navy Yard at Mare Island, Cal., showed 15.80 lbs. water evaporation per pound of oil as fired (California crude petroleum of 0.9504 specific gravity and 18,790 B.T.U. per lb.). Of the steam generated, 2.3 per cent. was required for atomization.

The specific gravity of crude oil varies from 0.884 to 0.951. The lighter oils—such as refined petroleum, benzine, and gasoline—are now extensively used for motive-power purposes.

An oil explosion engine mixes its supply of oil with air, explodes the mixture with more or less perfect combustion, and converts the potential energy of the oil into mechanical work. (See Gas Engine.)

Recent experiments by the U. S. Department of Agriculture have shown that crude denatured alcohol is a more efficient fuel for use in internal-combustion engines than the lighter petroleum oils like naphtha. If the price could be lowered so that the cost of equivalent heat contents approached petroleum derivatives, it would be largely used in their place. The calorific power is about 11,000 B.T.U. per lb., compared with 19,000 for gasoline. Heavier initial compression in the internal-combustion engines is essential to maximum economy with alcohol.

(3) Gaseous Fuels.—Ordinary illuminating gas is now extensively employed in small gas engines and shop and domestic appliances. It possesses the well-recognized advantages over solid fuel that it is easily handled, the combustion is under complete control, and causes no smoke, dirt, or ash. However, in many of these appliances the burned gas passes off into the room. Ventilation then requires special attention, in order to insure the health and comfort of the workers.

Producer Gas.—This fuel is now largely employed in America in glass, metallurgical, ceramic, brick, pottery, and by-product coke industries. There is a tendency to introduce it in all industries requiring high temperatures and using large quantities of coal. Its success is due to (1) the easy regulation of the combustion; (2) economy in labor, fuel, and heat; (3) the high temperature acquired.

Tests made at the St. Louis Exposition by Prof. R. H. Fernald showed that bituminous coal and lignite can be used in the manufacture of producer gas, and this gas can be consumed in internal combustion engines with a fuel economy of 50 per cent. One ton of coal used in a producer plant has developed on a commercial scale as much power as two and a half tons of similar coal used in a

modern steam boiler attached to a simple Corliss steam engine. Gas of a higher quality can be obtained from lignite than from high grade Pennsylvania bituminous coal, and a ton of ordinary lignite used in a gas-producer plant will yield as much power as the best Pennsylvania or West Virginia coal used under high-grade steam boilers. The bituminous-coal gas producer has not met with wide use as yet. The tendency of the fuel bed to coke and the excessive formation of tar vapors—troubles not encountered in the anthracite producer—remain to be overcome. (See GAS MANUFACTURE, *Producer Gas.*)

Oil Gas.—Gas for fuel has also been made from crude oils. By one process small amounts of oil are used to heat retorts into which sprayed oil and air are passed. In this way a gas can be made, without tar or excessive lampblack, which tests show to have 30 per cent. nitrogen, 5.5 hydrogen, 1.5 CO, 2 CO_2, 35 CH_4 (methane), and 25.5 per cent. ethylene, acetylene, etc. (845 B.T.U. per cubic foot). Another process, in which the products of combustion pass along with distilled oil vapors into the hot super-heated section, gives a gas of from 170 to 270 B.T.U. per cubic feet, and analyzing 57–60 per cent. nitrogen, 4–6.5 CO_2, 0.2–0.4 CO, 10–12 hydrogen, and the rest methane, etc. In these processes the oxygen of the air seems to combine with hydrogen in the superheater or retorts to form water, instead of uniting with the carbon to form CO_2. (See GAS MANUFACTURE, *Oil Gas.*)

PREPARED FUELS.—Powdered coal, after being washed, to remove as much foreign matter as possible, is mixed and ground with from 8 to 10 per cent. of tar, pitch, or similar binding material. The mixture is heated to the softening point of the pitch (over 170° F.), either by the external application of heat or by blowing in steam, and moulded into blocks under considerable pressure.

The utilization of coal in the form of fine powder has attracted the attention of many engineers. But in spite of apparent advantages, no wide use of this fuel is seen. The advantages cited are: (1) complete combustion, which means smoke elimination and good efficiency; (2) ability to use cheaper coal; (3) possibility of rapid increases in furnace capacity; (4) small labor cost. There is the disadvantage for some localities, that large amounts of ash dust are thrown into the atmosphere.

Only bituminous coals have been successfully used alone, as a coal low in volatile matter is apt to pass through partly unconsumed; but mixtures with anthracite as high as 70 per cent. have been employed. Coal dust in air is very explosive, once the evolution of volatile matter is initiated locally. First cost and furnace depreciation are increased on account of high temperatures.

There are two general methods —(1) those feeding coal dust, and (2) those with self-contained burners which both reduce the lump coal and feed the dust. The dust is either moved by air, or scattered into the combustion chamber by mechanical means.

Consult A. H. Sexton's *Fuel and Refractory Materials;* Mills and Rowan's *Fuel and its Application;* Fulton's *Manufacture of Coke* (1905); Damour's *Furnace Construction* (1906); U. S. Geological Survey *Report on Fuel Tests at the St. Louis Exposition* (1906); Redmayne's *Modern Practice in Mining* (1908); Tonge's *Coal* (1907); recent *Reports* of the U. S. Bureau of Mines, U. S. Geological Survey, and Illinois Engineering Experiment Station.

Fuels, Calorific Power of. The calorific power of any fuel may be determined by calculation, if its composition is known, or by burning a weighed quantity of the fuel, and absorbing the heat given off in a known weight of water. By the first method it is necessary to know the calorific power of each heat-producing element of which the fuel is composed. One pound of hydrogen, when burned with 8 lbs. of oxygen to form 9 lbs. of water, gives off 62,032 British thermal units (B.T.U.). Also, 1 lb. of solid carbon requires 2.67 lbs. of oxygen to form 3.67 lbs. of carbon dioxide (complete combustion), and 14,500 B.T.U. are available; but if the quantity of oxygen is reduced to 1.33 lbs., forming 2.33 lbs. of carbon monoxide, the heat evolved is only 4,400 B. T. U., and the combustion is incomplete. If the temperature of the products of combustion is above 212° F., the water formed will be in the form of steam, and the true calorific power of hydrogen would then be 62,032—(966×9)=53,338 B.T.U. But when stating the calorific power of a substance, it is preferable not to deduct the latent heat of the water.

The effect of oxygen in a fuel is always adverse to its heating value. It is generally assumed that the oxygen is already in combination with sufficient hydrogen to form water, and may therefore be left out of consideration in determining the calorific power. Let C, H, and O represent the weights of carbon, hydrogen, and oxygen in 1 lb. of the fuel. Subtract $\frac{O}{8}$ from H, and the remainder is the available hydrogen. From the above figures it is evident that the calorific power of hydrogen is about 4.28 times that of carbon; therefore the calorific power of 1 lb. of fuel may be expressed thus: Calorific power (B.T.U.)=14,500 $\left\{ C + 4.28 \left(H - \frac{O}{8} \right) \right\}$.

CALORIFIC POWER OF VARIOUS FUELS, IN BRITISH THERMAL UNITS, PER POUND OF FUEL.

Fuel.	Calorific Power.	Equivalent Evaporative Power from and at 212° F.
Wood (average), dry	7,200	7.45
Wood (average), 20 per cent. water	5,100	5.28
Peat, kiln-dried	9,500	9.84
Peat, air-dried	7,240	7.50
Charcoal (wood)	13,000	13.45
Charcoal (peat)	12,300	12.73
Coal, anthracite	15,200	15.71
Coal, bituminous (best)	15,500	16.05
Coal, bituminous (average)	14,800	15.31
Cannel	15,075	15.61
Lignite	11,214	11.61
Coke (average	12,760	13.20
Petroleum (average)	20,000	20.68
Pennsylvania heavy crude oil	20,736	21.48
Caucasian heavy crude oil	20,138	20.85
Borneo heavy crude oil	18,800	19.45
Petroleum refuse	19,832	20.53
Tar refuse	17,400	18.00

Fuels, Calorific Power of

There are possible sources of error in the above method. The calorific power of the carbon and hydrogen as given assumes these bodies to be in the free state, not in combination as in a fuel, and their calorific powers when in combination may be different. Again, compound bodies never give out the same amount of heat on combustion as the elements of which they are composed would do in the free state. Hence, when the calorific power of a fuel is required with a practical degree of accuracy, it is advisable to determine it experimentally by means of a calorimeter.

One such is shown in Fig. 1. It is a modified Thomson's coal calorimeter. A weighed quantity (2 grams) of the coal to be tested is placed in a platinum crucible A, supported in a small metal brazier inside a glass bell E, which is secured to a base plate F by means of a brass ring and bayonet joint; there is an india-rubber washer between the bottom of the bell and the base plate, to form a water-tight joint. The bell and its connections are contained in a glass vessel H, which is supported inside a thick glass cylinder L, thus providing an air jacket to minimize losses due to radiation. The oxygen necessary to bring about the combustion of the fuel is introduced through a tube T, which is connected to the bell by a short piece of rubber tube I, so that the tube T can be raised or lowered in the bell as may be required. The fuel is ignited by a short piece of fuse—cotton wick impregnated with nitrate of potassium—or by means of a platinum coil heated to redness by an electric current. The products of combustion pass downward through four small tubes in the base plate, escaping from nozzles, and rising through the water contained in the vessel H, give up their heat to the water. A sensitive thermometer N indicates the temperature of the water before and after the experiment. The weight of water (2,000 grams) in the vessel H, and the water equivalent of the apparatus, must be known, also the rise in temperature of the water during the experiment, and any correction due to radiation and other losses.

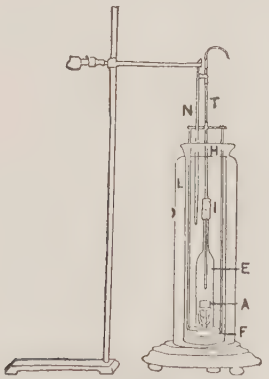


FIG. 1.—*Thomson's Coal Calorimeter.*

There are several other forms of calorimeters, but the principle involved is practically the same —*i.e.*, measuring the heat given out on the combustion of a fuel by absorbing the heat in a weighed quantity of water.

The calorific value of a gas, or the number of heat units given out by the complete combustion of a cubic foot, is determined in a special form of apparatus, somewhat similar to Fig. 2, which shows a Junker's gas calorimeter. The gas to be tested first passes through a standardized wet gas meter M, capable of accurately indicating the consumption to a small fraction of a cubic foot; sometimes a pressure regulator is introduced between the meter and the calorimeter C. The gas is burned in a bunsen burner placed in the interior of the calorimeter, and the products of combustion pass up a central chamber, descend through a number of small tubes, and finally escape into the atmosphere through a tube E. The heat in the products of combustion is absorbed by water which circulates round the tubes as it passes through the calorimeter. The cold water enters through a pipe F into a tank H, which is provided with an overflow pipe K. An excess of water is supplied so that there is always a quantity flowing to waste. The water to the calorimeter passes down the pipe L. The above arrangement ensures a constant head of supply water and a constant rate of flow. The quantity of water admitted is regulated by a tap T, and its temperature is ascertained by means of a thermometer N, a thermometer P indicating the temperature at discharge. The water is finally received into a measuring vessel R, and the quantity noted. The calorific value of a gas can be easily calculated from the observed rise of temperature of the circulating water, and the weight of water used. A small correction requires to be made for the steam produced during combustion, which is drawn off as water through the pipe W and weighed.

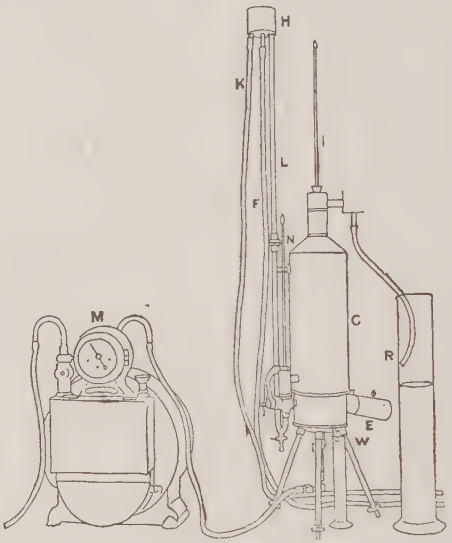


FIG. 2.—*Junker's Gas Calorimeter.*

The same calorimeter can be used for determining the calorific value of petroleum. Instead of the bunsen burner is substituted a vaporizing lamp, in the reservoir of which the oil is contained under a small air pressure. The lamp practically forms one scale pan of a balance which weighs the quantity of oil consumed—the rise of temperature of the circulating

water, and the quantity used, being noted at the same time.

Average Figures for Calorific Power of Gaseous Fuels (in B.T.U. per cubic foot).

	Calorific Power.
Coal gas (illuminating)	660
Carburetted water gas (illuminating)	645
Water gas (from coke)	375
Producer gas (anthracite)	137
Producer gas (bituminous)	157
Blast-furnace gas	100
Natural gas	1000

Fuente-Alamo, town, Murcia province, Spain; 18 miles south of Murcia. Pop. 10,000.

Fuente de Cantos, town, Badajoz province, Spain; 54 miles southeast of Badajoz. It has copper mines. Pop. 8,500.

Fuente del Maestre, town, Badajoz province, Spain; 30 miles southeast of Badajoz. Pop. 7,000.

Fuente Ovejuna, town, Cordova province, Spain; 48 miles northwest of Cordova. There are silver-lead mines and stone quarries. Pop. 12,000.

Fuenterrabia. See FONTARABIA.

Fuentes de Andalucia, town, Seville province, Spain; 35 miles northeast of Seville. Pop. 6,800.

Fuentes de Oñoro, village, Salamanca province, Spain; 65 miles southwest of Salamanca. It was the scene of the indecisive battle between Wellington and Masséna (May 3-5, 1811), which kept the French out of Portugal. Pop. 1,200.

Fuero (from Latin *forum*), applied in Spain to a code of laws, to national, provincial, and municipal charters, and to privileges granted to certain communities.

The Spanish national code of laws is called the *Fuero Juzgo* The foundation of the code was a primitive adaptation by Euric (d. 483) of the Theodosian code. Revised codes were promulgated by Ægica (d. 701); by Ramon Berenguer and the Council of Gerona in 1068; and by James the Conqueror (d. 1276). In the realms of Castile the Fuero Juzgo was again consolidated, and ordered to be put into the vernacular by Ferdinand the Saint (d. 1252); but it remained for Alfonso the Learned (d. 1284), his son, to recast and revise it entirely, with the inclusion of a vast mass of local and customary law, as the famous code called the *Siete Partidas,* the greatest compilation of the kind since the code of Justinian, upon which it was modelled. This superseded (1348) the Fuero Juzgo, and remained the basis of Spanish law until recent times.

The municipal fueros, in many cases, gave practical independence to the urban communities, with control of large territories outside their walls. The *realengo* towns, holding fueros direct from the sovereign, were represented in the king's councils, and at one time controlled the whole state. The *solariego* towns, holding fueros from tributary nobles, possessed, until the decadence of public life in Spain at the end of the fourteenth century, the most perfect autonomy. Many of them held what was called the *Fuero de Behetria,* which gave them the right of choosing their own overlord for life. Others enjoyed the *Fuero de Albedrio,* which gave them the right of self-government with very light service to the hereditary overlord. The whole of these varying charters were collected and confirmed—the Fueros de Albedrio by Sancho IV. (d. 1295), and the Becerro de Behetria by Alfonso XI. (d.1350). The most important provincial fueros were those of the three Basque provinces (Viscaya, Guipuzcoa, and Alava), although they were less ancient than that of Leon (1020) and some of the municipal charters—*e. g.,* San Sebastian (1150). These three provincial fueros gave to the Basques legislative, fiscal, administrative, and military autonomy—the king of Spain being recognized only as lord of Biscay. It was the wish to preserve these privileges that gave strength to the Carlist cause, and they were finally abolished after the last defeat of Don Carlos in 1876.

Fuerteventura, or FORTEVENTURA, one of the Canary Islands, east of Gran Canaria. Its capital is Betancuria, on the western coast; but its principal harbor is Cabras, on the eastern side. Area, over 650 square miles. Pop. 13,000.

Fuerth. See FURTH.

Fugger, a family of merchant princes of Augsburg, tracing their descent to a certain Johann, who settled in Augsburg in 1368. He and his son Johann (d. 1409) were well-to-do weavers of cotton. The wealth of the family was largely accumulated by Jakob (d. 1469) and his sons, who mined silver in Tyrol, embarked in money-lending, and were successful in speculative trading all over Europe. One of these sons, Jakob (d. 1525), lent large sums of money to the emperors Maximilian and Charles V., and his nephews were created counts of the empire by Charles. The family still survives. Consult Stauber's *Das Haus Fugger.*

Fugitive Slave Laws were two enactments of the United States (passed in 1793 and 1850), devised to facilitate the return to their masters of escaped slaves.

In colonial times and under the Articles of Confederation, fugitive slaves were frequently surrendered by the colony or State in which they were found as a matter of comity; but the Constitution expressly provided that 'no person held to service or labor in one State under the laws thereof, escaping into another, shall, in consequence of any law or regulation therein, be discharged from such service or labor, but shall be delivered up on claim of the party to whom such service or labor may be due.' The procedure to be adopted for this end was laid down in an act of Congress of 1793, which was amended by another more stringent one passed in 1850. The owner had under these statutes full power to arrest an escaped slave in any State to which he might have fled, either personally or through a specially authorized agent. The fugitive was then brought before a Federal judge or local magistrate, who, on the fact of ownership being proved, sanctioned his restoration to the master or agent. The State courts could not interfere with these proceedings by the issue of a writ of *habeas corpus.*

In spite of the penalties denounced against those who should hinder the arrest of fugitive slaves, the Act of 1850 had the effect of increasing the hostility to the whole system of slavery, and a greater number of successful escapes were made after it than before. In 1864 the obnoxious acts were for the most part repealed, and in 1865 slavery was altogether abolished by the Thirteenth Amendment to the Constitution. It is to be observed that under the fugitive slave law only persons who *escaped* could be reclaimed. Accordingly, a slave taken by his master to a free State or Territory or a child born of an escaped female slave were exempt from its provisions. See PERSONAL LIBERTY LAWS; SLAVERY AND SLAVE TRADE; UNDERGROUND RAILROAD. Consult McDougall's *Fugitive Slaves.*

Fugleman, a soldier who used to be posted on a wing or flank of the regiment in advance of his comrades, to set the time for certain exercises, such as fixing bayonets.

Fugue, a musical composition of which the basis is imitation. It consists essentially in the development of a melody, from four to eight bars in length, announcing the subject (or *dux*); this is transferred to the key of the octave, the perfect fourth or the perfect fifth, above or below, and repeated with or without slight modification, to form the answer (or *comes*). Other features are the counter-subject, the *stretto* (Ital. 'narrow,' 'close'), etc.; the former an accompaniment to the subject or the answer, the latter a drawing together of the subject and answer more closely than at the beginning. Any number of parts may be used, but they should preferably be introduced early. Much freedom of treatment is allowable, together with almost unlimited intricacies in the development by means of episodes, double subjects, coda, etc.; and the composition should increase in interest as the end approaches. Fugue differs from canon by requiring different work in each part; in canon the same melody is repeated by each part beginning at a fixed interval after its precursor. J. S. Bach is a master fugue writer; Handel's choruses and Mozart's symphonies afford many familiar and famous examples of the fugue. See Prout's *Fugue* (1891), and *Fugal Analysis* (1892).

Fuh-shan. See FATSHAN.

Fuji-san, FUJI-YAMA, FUJI-NO-YAMA, or, incorrectly, FUSI-YAMA, the highest mountain of Japan, 60 m. W. of Tokyo. Altitude, 12,425 ft. A dormant volcano of singular symmetry and majesty, it is a favorite subject with Japanese artists. The most recent eruption was in December, 1707.

Fu-kien, or FO-KIEN, maritime province in China, borders with Chekiang, Kiang-si, and Kwang-tung. **Area,** 46,320 sq. m. It has a subtropical climate. Its foreign trade depends mainly on the tea exported from Foochau, the capital and chief town, and Amoy. The tea plant is largely grown on the mountain sides, but there has been a large falling off in the trade. The province is remarkable for its beauty, the mountains which line the rivers being exquisitely clad with shrubs and timber. The people on the coast are active traders and fishermen, and were formerly pirates and wreckers. Fu-kien is celebrated for its fruits (*e.g.*, lichees, oranges, langans), and produces a considerable quantity of ginger, turmeric, etc. Besides the rice which is grown in irrigable country, sugar is also cultivated. The chief food of the laboring class, especially in the mountains, is the sweet potato. The multiplicity of dialects and the peculiar customs of the people separate it in many ways from the rest of China. Pop. (1936) 11,755,625.

Fukui, town, Japan, province Echizen, near the N.W. coast of Honshiu, 86 m. N.E. of Kioto, is noted for its paper and habutai silk. At the Renaissance Fukui became an important educational and ecclesiastical centre. Pop. 50,400.

FUJISAN, OR FUJIYAMA, THE MOST FAMOUS MOUNTAIN OF JAPAN. IT IS A DORMANT VOLCANO

Fukuoka, town, N.W. coast of Kiushiu, Japan, 65 m. N.E. of Nagasaki. It is chiefly famous for its silk and inwoven-picture fabrics. Pop. (1935) 291,158.

Fukushima, town in Iwashiro province, Nippon, Japan, 168 m. by rail north of Tokyo, and 85 m. southeast of Niigata, one of the first five ports opened to commerce. It is a trading centre for raw silk and silkworms' eggs. Pop. 33,500.

Fukushima, YASUMASA, BARON (1853–1919), Japanese soldier and diplomat, born in Matsumoto, in the province of Shinano. He served in the Japanese Foreign Office, entered the army as lieutenant

(1878), and became captain (1883). He served as *attaché* in Peking for two years, and in Berlin for five years. In 1893, in accordance with orders from the Emperor, he returned to Japan on horseback, making observations as he went through Russia and Siberia, a distance of 9,000 miles. He was raised to the rank of major (1888) and of major-general (1900). His international reputation was gained as commander of the Japanese contingent on the occasion of the Boxer uprising, when the Western allies were impressed with the discipline and efficiency of the Japanese troops. For his services on this occasion he was knighted by Edward VII. He was on the staff of Marshal Oyama in the war with Russia, and was known as one of the ablest of the Japanese strategists. He was promoted to the rank of lieutenant-general and vice-chief of the general staff (1906), and was created baron (1907). He wrote a number of books on his travels and on military matters in the Far East.

Fukuyama (formerly Matsumai), seaport at S. end of Yezo, Japan, 61 m. by rail S.W. of Hakodate. Pop. 15,000.

Fulahs (otherwise FELLATA, FELLANI, FULBE, and French *Peulhs*), the ruling native race in Nigeria and French Sudan, and founders of the sultanates of Sokoto and Gando. They are taller, fairer, and much less negroid than the surrounding Hausas (q. v.). According to Barth, the existing Fulahs are a blend partly of Arab and Berber, and partly of Berber and negro. At an early period they migrated westward to Senegal, whence they afterward (*c.* 1700) extended their influence eastward. In 1802 one of their sheiks, Othman dan Fodio, inaugurated a religious war throughout Nigeria, and eventually conquered Hausaland for Islam. The campaigns of 1897–1903, however, compelled the Fulahs to acknowledge British suzerainty. They probably number from six to eight millions. See Béranger-Féraud's *Peuples de la Sénégambie* (1879); Ratzel's *History of Mankind* (1896).

Fulcrum. See LEVER.

Fulda, town, Prussia, province of Hesse-Nassau, on the River Fulda, 69 m. by rail N.E. of Frankfort-on-Main. It owes its origin to a Benedictine abbey founded in 744, and in 968 given precedence over all other abbeys in Germany. Attached to the abbey was a theological school, famous for centuries. The abbacy was converted into a bishopric in 1752. Linen, cotton, cloth, saltpetre, etc., are manufactured. From 1734 to 1804 Fulda was the seat of a university. Pop. 20,500.

Fulda, LUDWIG (1862), German playwright, was born at Frankfort-on-Main. Since 1888 he has lived in Berlin; and in 1906 he visited the United States. His dramatic career began with a tragedy, *Christian Günther* (1882). He has written a number of clever comedies—*e.g.*, *Unter vier Augen* (1886) and *Die wilde Jagd* (1893); several dramas —as, *Das verlorene Paradies* (1892) and *Die Zwillingsschwester* (1901). The latter has been translated into English and presented in the United States. For his dramatic fairy tale, *Der Talisman* (1893), he was awarded the Schiller prize, but the German Emperor refused to sanction it. Fulda has also written *Sinngedichte* (1888) and *Gedichte* (1890); translations of Molière's plays (1892), and Rostand's *Les Romanesques* (1896) and *Cyrano de Bergerac* (22d ed., 1910).

Fulgoridæ, or Lantern Flies, a name given to a family of Hemiptera in which never more than two ocelli are present. Many species are prettily colored, this being true especially of the members of the genus Flata. In spite of the common name, satisfactory proof of luminosity in the family appears to be still wanting. See LANTERN FLY.

Fulgurites. On mountain summits, such as those of the Alps, it has occasionally been noticed that the surface of the rock shows in places a glassy film; and that fine depressions may be present, or small droplets of vitrified rock. It has reasonably been inferred that these are the effects of lightning. On sand-hills in many places, as in South America and North Africa, curious natural tubes have been found projecting above the surface, and these, when examined under the microscope, prove to consist of a thin film of glass enclosing sand grains. They range in size from an inch or two in diameter downward, and descend through the sand to depths of several feet, often branching in their course. These, too, are supposed to be produced by lightning, and are known as fulgurites.

Fulham, metropolitan borough of London, England, 2 m. S.W. of Hammersmith, and opposite Putney. See LONDON.

Fulica. See COOT.

Fuller, ANNA (1853), American author, was born in Cambridge, Mass. She was educated at the Abbott Academy, Andover, and made her permanent residence in Boston. Her first book of character sketches, *Pratt Portraits* (1892), met with immediate success. Among her other works are *Literary Courtship under the Auspices of Pike's Peak* (1893); *A Venetian June* (1896); *Katharine Day* (1901).

Fuller, GEORGE (1822–84), American painter, was born at Deerfield, Mass. He began work as an itinerant portrait painter, continued his studies in Boston and New York, and painted portraits and landscapes with but little encouragement during his early life. A portrait of his former teacher, H. K. Brown, gained him associate membership in the National Academy in 1857. Three years later, after a six months' tour of the European galleries, he returned to Deerfield. During his residence there, which lasted until 1876, Fuller developed the impressionistic style which characterized his subsequent work in landscapes and heads. His most notable paintings were the *Turkey Pasture in Kentucky*, *And She was a Witch*, and *Winifred Dysart*. Fuller was a founder of the Society of American Artists. See Van Rensselaer's *Six Portraits* (1889).

Fuller, HENRY BLAKE (1857), American novelist, was born in Chicago. His first stories, *Chevalier of Pensieri-Vani* (1891), and *Chatelaine of la Trinité* (1892), both romances, were followed by *The Cliff-Dwellers* (1893), and by *With the Procession* (1895), stories of Chicago. *The Puppet Booth* (1896) is a collection of twelve one-act plays. Other books have been: *From the Other Side* (1898); *The Last Refuge, a Sicilian Romance* (1900); *Under the Skylights* (1901); *Waldo Trench and Others* (1908).

Fuller, MELVILLE WESTON (1833–1910), American jurist and Chief Justice of the U. S. Supreme Court, was born in Augusta, Me., of a family of legal antecedents. He was graduated at Bowdoin College in 1853, and studied law at Harvard. From 1855 to 1858 he practised law in Augusta; was city attorney and member of the common council; and was an editor of the Augusta *Age*, a rival of James G. Blaine's Kennebec *Journal*. In 1856 he removed to Chicago. In 1862 he was a member of the Illinois constitutional convention, and the following year of the Illinois legislature; and he acted as a delegate to the Democratic National Conventions of 1864, 1872, 1876, and 1880. In 1876 he nominated T. A. Hendricks to a place on the ticket with S. J. Tilden. He defended the Rev. Dr. Cheney when he was tried for heresy, and subsequently was a founder of what was called the Reformed Episcopal Church. In 1888 he was appointed to the Chief Justiceship of the U. S. Supreme Court. He was regarded as an authority on international law, and was appointed in 1889 a member of the convention at Paris to arbitrate an adjustment of the disputed boundary between Great Britain and Venezuela; and in 1905, one of the peace commissioners at The Hague (see VENEZUELA). Among the important cases in which he gave his opinion were the nullification of the income tax law; the destruction of

the Northern Securities merger; the Danbury Hat case, in which the labor unions were held to be amenable to the Sherman Anti-Trust law; and the case of Inman *versus* the South Carolina Railway Company, in which the railroad company was denied the power to exempt itself from liability for negligence in shipping goods (see SUPREME COURT DECISIONS). He received the degree of LL.D. from Northwestern University, Bowdoin College, Harvard, Yale, and Dartmouth. He contributed biographical memoirs to Breese's *Early History of Illinois* (1884).

Fuller, SARAH MARGARET, MARCHESA OSSOLI (1810–50), American author, was born at Cambridgeport, Mass. She was the daughter of Timothy Fuller, a descendant of early New England settlers. Margaret, the oldest of eight children, received a careful education, being very precocious in her youth. She attended the schools of Dr. Park in Boston and the Misses Prescott in Groton, and after leaving the latter, at the age of fifteen, pursued her studies in Greek, Italian, English literature, and philosophy in and near her home. After her father's death (1834), she received pupils at Boston, and subsequently taught in a school at Providence. She first met Emerson in 1835, and soon became acquainted with other members of the famous group of Transcendentalists. In 1840–1 she edited *The Dial*, and in 1843–4 published her first books, *Summer on the Lakes* and *Woman in the Nineteenth Century*. She was an occasional visitor at Brook Farm, but not a resident there, as might be imagined from the ideal portrait of her in Hawthorne's *Blithedale Romance*. In 1844 Miss Fuller removed to New York and became literary editor of the New York *Tribune*. Her contributions to this paper comprise much of her best work, including not only literary criticisms, but many articles based on her investigations into the social conditions of the city. In 1846 she visited friends in Rome, Italy, and made many acquaintances among the *conoscenti;* she travelled also in Switzerland and Northern Italy. She was married to a young Italian, the Marquis Ossoli, in December, 1847. Madame Ossoli and her husband were associated with the Italian revolutionary movement of 1848–9, and after the capture of Rome were obliged to leave that city. They sailed from Leghorn for New York a few months later; the vessel was wrecked on Fire Island beach, July 19, 1850, and the Marquis and his family were drowned. Many of Margaret Fuller's papers were lost in the wreck, only her correspondence with her husband coming ashore. Selections from her autobiographical writings are given in the *Memoirs* by R. W. Emerson, W. H. Channing, and J. F. Clarke (1852). Her *Collected Works* (4 vols., 1855) were edited by her brother, Arthur B. Fuller. See *Life* by Julia Ward Howe (1883) and by Thomas W. Higginson (1884).

Fuller, THOMAS (1608–61), English divine, was born at Aldwinkle, Northamptonshire. He became in 1634 rector of Broadwinsor, Dorset. His *History of the Holy Warre* (the Crusades) appeared in 1639. In 1640 he was in London, where he won great fame as a preacher. About this time (1641) he published *The Holy State and the Profane State*. To the Solemn League and Covenant he refused to subscribe, and (1643) joined the king at Oxford, where he wrote *Truth Maintained*—a reply to Saltmarsh, who had attacked his views on reformation. The regiment of which he was chaplain being driven into Cornwall, Fuller went to Exeter, and became tutor and chaplain to the queen's daughter. Here (1645) he wrote *Good Thoughts in Bad Times*. In 1647 he wrote *Good Thoughts in Worse Times*, and *Cause and Cure of a Wounded Conscience*. In 1648 or 1649 the Earl of Carlisle made him perpetual curate of Waltham Abbey. In 1650 he produced his *Pisgah Sight of Palestine*, on the geography and history of the Holy Land. In 1655 he published his *Church History of Britain*, including that of the University of Cambridge. He wrote (1660) *Mixt Contemplations in Better Times*. At the Restoration he recovered his preferments and became a royal chaplain, but (Aug. 12, 1661) was carried from the pulpit of the Savoy to die (Aug. 16), leaving *The Worthies of England* to be completed by his son. There was something of the statesman in his views. His wit is never forced; writers exaggerate his 'quaintness,' and forget that it is seldom ungraceful. His imagination gives life to the driest details. See Lives by Russell (1874), Bailey (1874), Morris Fuller (1884); criticisms by Coleridge, Southey, Lamb; selections by Rogers and Jessop; a complete bibliography in Bailey's edition of the *Collected Sermons* (1874).

Fuller-Maitland, JOHN A. (1856–1936), author and musical critic, was born in London, and graduated from Cambridge (1879). He engaged in newspaper work, becoming in 1889 musical critic of the London *Times*. He contributed largely to the *Dictionary of National Biography*, and to the leading periodicals, and edited the appendix to the first edition of *Grove's Dictionary of Music*. He has written a *Life of Schumann* (1884), *Masters of German Music* (1894), *Age of Bach and Handel* (1902), and *English Music in the Nineteenth Century* (1902). His *English Carols* and *Fitzwilliam Virginal Book* have made important treasures of English music accessible to the public; *Brahms* (1911) is a complete monograph in the series called 'The New Library of Music.' From 1904 to 1910 he was editor-in-chief of the second edition of *Grove's Dictionary of Music*.

Fuller's Earth, a series of impure argillaceous sands found principally in the Jurassic strata of the west of England. Interbedded with the sands and clays is a blue marly limestone—the fuller's earth rock, from 20 to 150 ft. thick. Its characteristic fossil is *Ammonites subcontractus*, and it contains many brachiopods, molluscs, cephalopods, and other fossils. At one time this formation was of considerable importance, as yielding the principal supplies of fuller's earth for fulling wool, that is, cleansing it of grease. It is a soft, friable, granular clay with a greasy feel; it has a larger proportion of silica than ordinary clays; and it disintegrates when placed in water, forming an impalpable powder. Some varieties are blue, others yellow. The latter were most esteemed for practical purposes. These fuller's earth clays, which are not permeable, sustain large quantities of water underground, supplying many of the country's springs.

Fuller's earth was discovered in Florida in 1893. Deposits are also found in Arkansas, Colorado, Massachusetts, South Carolina, South Dakota, and Texas where it is mined or dug in the open. It is used largely in the filtration of mineral oils; in the formation of pigments for wall paper, certain soaps, and in decolorizing certain vegetable oils.

Fullerton, GEORGE STUART (1859–1925), American philosophical writer and educator, born in Fatehgarh, India. He was graduated (1879) at the University of Pennsylvania, and studied theology at Princeton and Yale. He was ordained a priest of the Protestant Episcopal Church in 1886. He became instructor in philosophy in the University of Pennsylvania (1883) and was professor of philosophy there from 1887 to 1904, when he accepted a similar chair at Columbia. Among his books are *Conception of the Infinite* (1887); *Plain Argument for God* (1889); *Philosophy of Spinoza* (1894); *System of Metaphysics* (1904); *Introduction to Philosophy* (1906).

Fullerton, LADY GEORGIANA (1812–85), English novelist and philanthropist, was born in Staffordshire, daughter of the first Earl

Granville. She married Alexander Fullerton (1833), and wrote *Ellen Middleton* (1844), *Grantley Manor* (1847), and *Lady Bird* (1852). After her reception into the Roman Catholic Church her writings were largely on Catholic subjects. Her last years were spent in practices of piety. See Oliphant's *Victorian Novelists* (1899), and *Inner Life of Lady Georgiana Fullerton* (1899).

Fulmar, or FULMAR PETREL (*Fulmarus glacialis*), a near ally of the giant petrel. It reaches a length of about nineteen inches, and though very variable in color, usually has the head, neck, and under surface white, and the back pearly gray, with darker wing

Fulmar Petrel.

quills. It is a Northern bird, and breeds in thousands on the Hebrides and other subarctic islands and coasts. It is known to sailors as 'mollemoke.' Only a single egg is laid, and there is practically no nest. A similar species occurs in the northern parts of the Pacific and in Bering Sea. See PETREL.

Fulminates are extremely explosive salts derived from fulminic acid or nitro-acetonitrile, $CH_2(NO_2)CN$. The best known is *mercury fulminate*, which is obtained by the action of alcohol and nitric acid on mercury nitrate. It is a gray crystalline solid that explodes violently on friction or percussion, and is used as the explosive agent in detonators and percussion caps.

Fulton. (**1.**) City, Oswego co., New York, 23 m. N.W. of Syracuse, on the Oswego R. and Oswego Canal, and the N. Y., O. and W., N. Y. Cent., and D., L. and W. RRs. The manufactures include woollens, flour, paper, and cutlery. Fulton was settled about 1791. Oswego Falls was included in Fulton when it was incorporated as a city in 1902. Pop. 10,480.

(**2.**) City, Missouri, county seat of Callaway co., on the Chi. and Alt. RR.; 23 m. N.E. of Jefferson City. It is the seat of Westminster College (Presb.), Synodical Female College, William Woods College for girls, State Insane Hospital, and Missouri School for the Deaf. Fire-brick and pottery are manufactured; in the vicinity are important coal mines and mineral springs. Live-stock and grain are raised in the surrounding district. Pop. 5,228.

(**3.**) Town, Fulton co., Kentucky, 42 m. S.S.W. of Paducah, on the Ill. Cent. RR. There are tobacco rehandling houses, and manufactories of carriages, furniture, lumber, and flour. It is the seat of Fulton Normal School. Pop. 2,575.

(**4.**) City, Whiteside co., Illinois, on the Mississippi River, just above Clinton, Ia., and on the Chi., Burl. and Quin., Chi. and N. W., and Chi., Mil. and St. Paul RRs. Northern Illinois College and Hanson Military Institute are situated here. Lyons High Bridge over the Mississippi, High Bluffs, and Stony Point Park are of special scenic interest. Pop. 2,174.

Fulton, CHARLES WILLIAM (1853-1918), American legislator, born in Lima, O. He removed to Astoria, Ore., and was admitted to the bar in 1875. He was elected State senator in 1878, 1890, 1898, and 1902, and was presiding officer in 1893 and 1901. In 1902 he was chosen U. S. Senator for the term of 1903–09.

Fulton, ROBERT (1765–1815), American inventor and engineer, born at Little Britain, Pa., of Irish parentage. He had small regular schooling, but applied himself to his studies assiduously. At the age of seventeen he was apprenticed to a jeweller in Philadelphia. He also took up miniature and landscape painting, and in a few years earned sufficient money to buy a farm for the support of his mother. He then went to England to study under West. His attention, however, was soon turned to mechanical inventions, and he took out patents for several useful appliances, including machines for marble-sawing, rope-making, flax-spinning, dredging, and a device for canal improvement. In 1797 he went to Paris, where, in 1803, he constructed a small steamboat which navigated the Seine. He returned to America in 1806, and in 1807 launched the *Clermont*, which travelled by steam from New York to Albany (150 miles). She made the return trip in 32 hours, and thereafter plied regularly on the river. This was the beginning of successful steam navigation. He was later employed by the U. S. Government in canal construction. Among his inventions were a submarine torpedo boat, and a steam war-vessel, the *Demologos*. The latter was built by the government, and launched in 1815. The *Demologos* carried a heavy armament and had furnaces for heating the shot, and although she did not attain much speed, she might have proved formidable if she had been launched in time to participate in the war. She was blown up accidentally in 1829. See Colden's *Life* (1817); Knox's *Fulton and Steam Navigation* (1886); Miller's *Story of Robert Fulton* (1908).

Fulton, ROBERT BURWELL (1849–1919), American educator, born in Sumter County, Ala. He was graduated at the University of Mississippi (1869). He was adjunct professor of physics and astronomy (1872–5), professor (1875–1906), and chancellor (1892–1906) at the University of Mississippi. In 1906 he became superintendent of the Miller School. He was president of the National Association of State Universities (1896–1903). He exerted considerable influence on the educational development of the South.

Fulton-Hudson Celebration, marking the one hundredth anniversary of Fulton's inauguration of steam navigation, and the three hundredth anniversary of Hudson's discovery of the river bearing his name, extended from Sept. 25 to Oct. 9, 1909, and was observed by all the cities and towns along the Hudson River, particularly by New York and Albany. It was largely naval in character, 50 war vessels being present, 20 of them from foreign countries. The river parade, which was miles in length, and consisted of hundreds of decorated vessels of all sorts, was led by reproductions of Fulton's *Clermont* and Hudson's *Half Moon*. There were also extensive military and civic parades on shore, and illuminated river parades at night.

Fulvia, a Roman woman of the first century B.C., of dissolute character. She was married first to P. Clodius, then to Q. Scribonius Curio, and lastly, in 44 B.C., to Mark Antony. In 40 B.C., during his absence in the East, she raised a revolt in Italy against Augustus, and was besieged in Perusia. On its fall she escaped, and joined Antony at Athens, but was coldly received by him, and in the same year she died at Sicyon. Cicero attacks her character in his second philippic. See ANTONIUS, MARCUS.

Fumaric Acid, Maleic Acid, two organic acids having the same molecular composition ($C_4H_4O_4$) and the same chemical constitution (COOH.CH:CH.COOH), but differing in physical and chemical properties. Fumaric acid occurs in fumitory and some other plants, and may be prepared by heating its stereoisomer maleic acid. It forms very sour, needle-like crystals that are almost insoluble in water, and sublimes at 200° C. At higher temperatures it is converted into anhydrous maleic acid. Maleic acid crystallizes in the form of rhombic prisms which melt at 130° C. and are readily soluble in water.

Fumigation. (**1.**) In medicine, purification by the burning or heating to the point of volatilization of drugs (such as sulphur) which when burned are antiseptic. Four pounds of sulphur are used for each 1,000 cubic feet of space.

Mercury also is used, volatilized together with hot steam, not for the purpose of disinfecting a room or clothes, as sulphur may be, but for its action upon the skin. Many antiseptics are used in the form of vapor, either for general disinfection of rooms, or for local application to the mouth, throat, or lungs. (See DISINFECTANTS and ANTISEPTICS.) (2.) A process employed by gardeners for destroying certain insects which threaten the plants of conservatory, open garden, or greenhouse. Tobacco is the substance usually employed, and one of the most effective appliances is a wire basket, one foot square and six inches deep, with a strong wire from each corner by which to suspend it. Into the bottom of this throw a handful of hot cinders, and over that another handful or two of hot charcoal. Then swing the basket about for a few minutes, and you have a good red fire. The best tobacco for fumigating is common stems. In using the tobacco, procure a handful or two of wet litter from the stable, and chopping it into pieces about an inch long, mix it with the tobacco as intimately as possible. Then place it on the fire, give the basket a swing or two in the air, and its smoke will fill the house in a few seconds. Suspend the basket in the house, and damp the tobacco should it burst into flame. The fumigation should be repeated about two days afterwards. The evening is the best time for fumigating, and still weather should be taken advantage of. Remove all plants in bloom, as the flowers soon fall after exposure to the smoke. The foliage must be perfectly dry at the time, but a thorough syringing is desirable on the morning following.

Fuming is the name given to the property that some gases and vapors possess of forming a white cloud in air. It is usually due to the formation of solid or liquid particles by union of the vapor with the moisture ordinarily present in the air.

Fumitory, or FUMARIA, is a

Common Fumitory.

genus of herbaceous plants belonging to the order Fumariaceæ. Among the European species is the common fumitory of waste ground (*F officinalis*), whose smoke was once thought useful for expelling evil spirits. The climbing fumitory, which trails its delicate stems and foliage, and drooping clusters of shell-pink flowers, over thickets, is *Adlumia fungosa.*

Robert Fulton.

Funabashi, large tn., Niphon, Japan, on N.W. of Tokyo Bay, 11 m. E. of Tokyo. Pop, 19,200.

Funaria, a widely distributed genus of mosses, common on old walls, ditches, and dry barren places, especially where a wood fire has been burnt. *Funaria hygrometrica* twists the stalk in proportion to the degree of moisture in the atmosphere.

Funchal, seapt. tn., episc. see, and health resort, cap. of the Madeira Is.; stands on the S. coast of the largest island (Madeira). Although it has only an open roadstead, it exports wine ($675,000 to $925,000), embroidery, and fruits, and imports coal, cereals, and textiles to the aggregate annual value of $3,000,000 to $3,500,000. It is largely visited in winter by convalescents (mostly British) from pulmonary and other diseases. Pop. (1930) 211,601.

Function, in mathematics. The notion of a function may be best illustrated by the statement of two simple cases. If we consider a series of triangles, all of the same altitude, the area of any one of the triangles will be known or determined whenever its base is known: to one value of the base there corresponds one value of the area; the area is therefore said to be a function of the base. Again, it is known that, for a given mass of gas, the pressure varies directly as the absolute temperature, and inversely as the volume; to each value of the volume and of the temperature there corresponds but one value of the pressure; the pressure is therefore said to be a function of the volume and of the absolute temperature.

In general, one quantity is said to be a function of one or more other quantities, when to each value of the latter there corresponds a definite value of the former. The latter quantities are called the arguments of the function; frequently the phrase

'independent variable' is used instead of 'argument,' and the function is then called the dependent variable. Magnitudes, geometrical or physical, usually enter into calculations through their measures, and the word 'quantity' used above may apply either to the magnitude or to its measure; the measures will then be the variables.

A function is often denoted by a single letter, as y; frequently it is represented by enclosing the argument or arguments within a bracket and prefixing a letter, called the functional letter or symbol, as $f(x)$, $f(x, y)$, $F(x, y, z)$. To express the kind of function considered, an equation between the function and its arguments is usually required; or, in mathematical language, it is said that the function is defined by an equation. For example, the equation $y = ax^2 + bx + c$ defines y as a function of x; the quantities a, b, c are not supposed to change as x (and therefore y) changes, and are therefore called the constants of the function. When the equation is solved for y in terms of x, it is said to define y explicitly, or as an explicit function of x; when the equation is not solved, it is said to define y implicitly, or as an implicit function of x. Thus, $y^2 - 2xy - x^2 - 1 = 0$ defines y implicitly; explicitly we get by solving the equation $y = x \pm \sqrt{(2x^2 + 1)}$. Here y is called a two-valued function of x; it is made up of two functions, $x + \sqrt{(2x^2 + 1)}$ and $x - \sqrt{(2x^2 + 1)}$. In the graphical representation these represent two parts of one curve.

Functions are divided into two main classes—(1) algebraic functions; (2) transcendental functions. The simplest example of class (1) is the power, with a constant coefficient, as ax^n, $ax^m y^n$, $ax^m y^n z^p$ . . . ., where m, n, p are positive integers. The sum of any number of such terms is called an integral rational function; the quotient of two such functions is called a fractional rational function; the most general algebraic function (u say) of the arguments x, y, z , . . . is defined by the equation $Au^n + Bu^{n-1} + \ldots + Ku + L = 0$, where A, B, . . . K, L are integral rational functions of x, y, z . . . . Of class (2), which includes all functions other than algebraic, the simplest are: (*a*) the trigonometric functions $\sin x$, $\cos x$, $\tan x$ . . . ., and their inverses $\sin^{-1}x$, $\cos^{-1}x$, $\tan^{-1}x$ . . . .; (*b*) the exponential function e^x, and its inverse, the logarithmic function, $\log x$.

In the calculus variables are supposed to be in general continuous. To see the meaning of this term, consider a point P moving along a straight line from one position A to another B, and let the distances of A, B, and P from a fixed point O on the line be a, b, x respectively. Then as P moves from A to B, it will coincide once with every point on the line between A and B; x therefore will take once every value lying between a and b. A variable number x which changes in this way from a to b is said to vary continuously, or to be a continuous variable. The functions considered in mathematics are usually such that when their arguments vary continuously, the functions themselves vary continuously. It is a corollary from this statement that, when each argument makes only a small change, the function itself will only make a small change; and this statement holds true of all ordinary functions, except for special values of the argument or arguments. In the graphical representation (see GRAPHIC STATICS) of a function of one variable, the graphic point, whose ordinate represents the value of the function when the abscissa represents that of the argument, traces out a continuous curve, as the abscissa of the point traces out a continuous segment of the axis of abscissæ.

In recent times the study of functions defined in a purely arithmetical manner has given rise to a special branch of mathematics called *the theory of functions*. The whole theory is built up from the notion of the integral number, and is severely logical in its development, discarding altogether geometrical intuition in its demonstrations. For an excellent introduction, the reader may be referred to Harkness and Morley's *Introduction to the Theory of Analytic Functions* (1898), and *Treatise on the Theory of Functions* (1893); Forsyth's *Theory of Functions* (2d ed. 1900); Whittaker's *Modern Analysis* (1902); and Merriman and Woodward's *Higher Mathematics* (1896).

Functions, Elliptic. A rational function of x and y, where y is the square root of a quadratic function of x, requires for its integration only the elementary functions (see FUNCTION); but when y is the square root of a cubic or of a quartic function of x, it is no longer possible, in general, to effect the integration by means of the elementary functions. In this case an integral of a rational function of x and y can be made to depend on three fundamental types, called elliptic integrals of the first, second, and third kind, the name elliptic being given because the integral of the second kind expresses the length of an arc of an ellipse. When y is the square root of a polynomial in x of a higher degree than the fourth, the integration requires hyper-elliptic integrals.

The elliptic integral u of the first kind is defined by the equation

$$u = \int_0^x \frac{dx}{\sqrt{[(1-x^2)(1-k^2x^2)]}}, \text{ or}$$

$$u = \int_0^\phi \frac{d\phi}{\sqrt{(1-k^2\sin^2\phi)}}, \text{ where } x = \sin\phi$$

When ϕ is considered as a function of u, the three functions $\sin\phi$, $\cos\phi$, $\sqrt{(1-k^2\sin^2\phi)}$ are called elliptic functions; k is called the modulus; ϕ is called the amplitude of u, written $am\, u$; and the three functions $\sin am\, u$, $\cos am\, u$, $\sqrt{(1-k^2\sin^2 am\, u)}$ are usually contracted into $sn\, u$, $cn\, u$, $dn\, u$. The passage from the elliptic integral to the elliptic function led to very extensive developments of the theory.

One of the most important properties of the elliptic functions is their double periodicity (see FUNCTIONS, PERIODIC): thus, $sn\, u$ has the real period $4K$ and the imaginary period $2K^1\sqrt{-1}$, where K is the value of u when $\phi = \pi/2$, and K^1 the value of u when $\phi = \pi/2$, and k is replaced by the complementary modulus $k^1 = \sqrt{(1-k^2)}$. The elliptic functions possess an algebraic addition theorem—*i.e.* a theorem analogous to that which expresses $\sin(A+B)$ in terms of sines and cosines of A and B.

The elliptic functions are functions not only of u, but of the modulus k; the investigation of properties dependent on the modulus, and the expression of the functions in infinite series and in infinite products, have given rise to numerous important special theorems, and generally have led to some of the most characteristic features of modern mathematics. In recent years it has become customary to define elliptic functions without reference to elliptic integrals, and in the hands especially of Weierstrass the subject has thus acquired greater consistency, and its formulæ greater flexibility, though the earlier methods of Jacobi are still of more than historical interest.

The literature of elliptic functions is enormous. For an introduction the following may be recommended: Greenhill's *Elliptic Functions* (1892), combining the Jacobian and Weirstrassian treatment); Dixon's *Elliptic Functions* (1894); Durège's *Elliptische Functionen* (1887); Appell and Lacour's *Fonctions Elliptiques* (1897). Of the larger works the standard book is Halphen's

Fonctions Elliptiques (3 vols. 1886); and for the historical development, Enneper's *Elliptische Functionen* (2d ed. 1890). The works on function theory by Harkness and Morley, by Forsyth, and by Whittaker contain much that bears on elliptic functions.

Functions, Periodic. Of the elementary mathematical functions (see Function), those called the trigonometric functions possess the remarkable property that when the angle is increased or diminished by 360°, or by any integral multiple of 360°, the value of each function is not altered. These functions are therefore called periodic, and the angle 360°, or its equivalent 2π radians, is called the period; the tangent and the cotangent have the shorter period, 180°, or π radians. In general, a function $f(x)$ of a single variable x is called periodic, its period being a, if $f(x \pm na)$ is equal to $f(x)$ for every integral value of n.

The most important theorem regarding periodic functions of a single variable is the following (Fourier's theorem): Every continuous single-valued periodic function $f(x)$, of period a, can be expressed as a convergent series of the form—

$$\frac{1}{2}A_0 + \Sigma A_n \cos\frac{2n\pi x}{a} + \Sigma B_n \sin\frac{2n\pi x}{a},$$

where n has all values from 1 to ∞.

The coefficients are definite integrals—

$$A_n = \frac{2}{a}\int_0^a f(u)\cos\frac{2n\pi u}{a}du;$$

$$B_n = \frac{2}{a}\int_0^a f(u)\sin\frac{2n\pi u}{a}du.$$

(See Fourier Series.) Fourier's theorem has a wider range than the above enunciation indicates: $f(x)$, for example, may have a finite number of discontinuities, but the form given to it above sufficiently indicates its nature.

A function $f(x, y)$ of two variables is called periodic, its periods being a, b, if $f(x \pm ma, y \pm nb)$ is equal to $f(x, y)$ for every integral value of m and of n. A similar theorem to that just given for a function of a single variable holds for a function of two variables; the definitions and expansions can be easily extended to functions of more than two variables, but these are of less importance.

Though not periodic functions of two variables in the sense just defined, we may rank with periodic functions those called spherical surface harmonic functions. These are functions of the angular (polar) co-ordinates θ, ϕ of a point on a sphere and are solutions of a certain differential equation (Laplace's equation). The harmonics of the one variable θ are called zonal surface harmonics. There is a theorem corresponding to Fourier's theorem for the expansion of any continuous function of θ, ϕ in terms of surface harmonics.

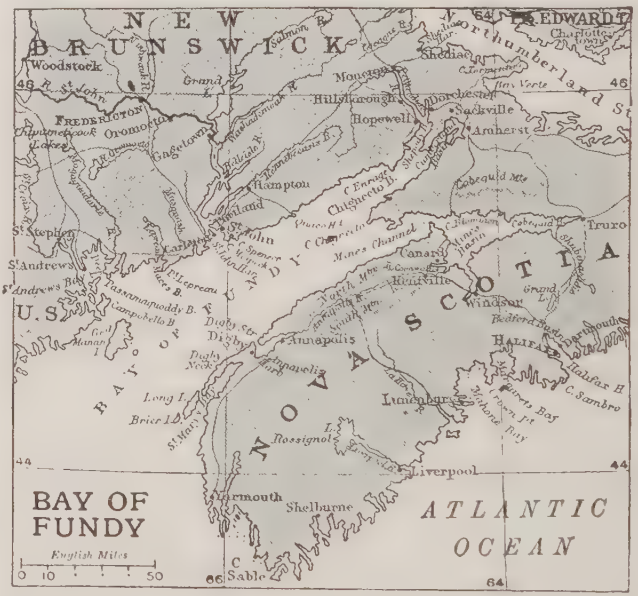
A doubly-periodic function $f(x)$ of a single variable x is one such that $f(x \pm ma \pm nb)$ is equal to $f(x)$ for every value of m and of n; a, b are called the periods of the function. It is impossible, however, for a function to be doubly periodic if both periods are real; further, a single-valued analytic function cannot have more than two distinct periods. None of the elementary functions are doubly periodic; the simplest doubly periodic function is an elliptic function.

For the treatment of Fourier's theorem and allied theorems, the reader may consult Byerly's *Fourier Series and Spherical Harmonics* (1895); Todhunter's *Functions of Laplace* (1875); Ferrers's *Spherical Harmonics* (1877); Heine's *Kugelfunctionen* (1878).

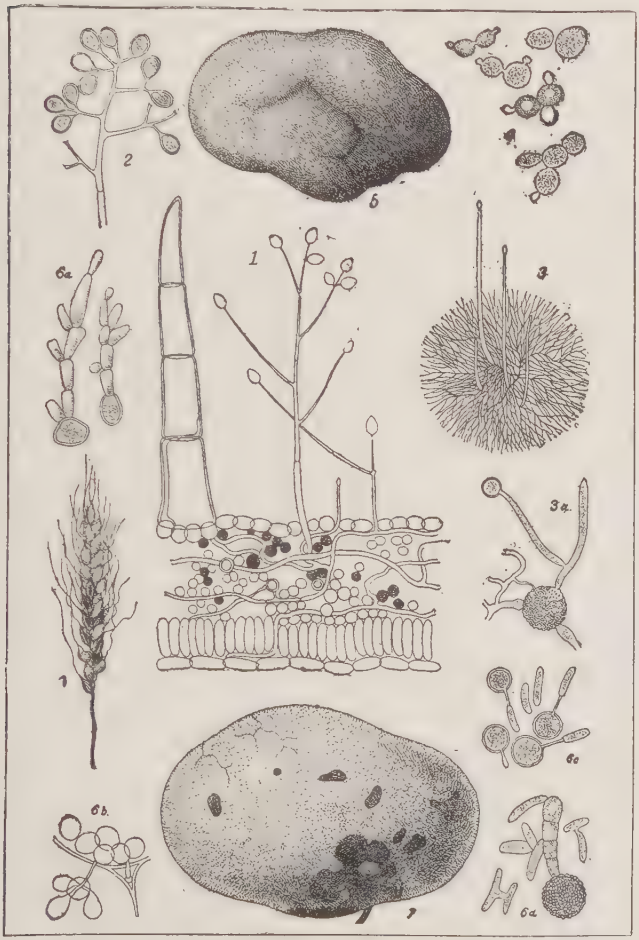
Fundamental Constitutions. See North Carolina.

Fundamental Orders of Connecticut. See Connecticut.

Fundy, Bay of, an arm of the N. Atlantic Ocean, 145 m. in length and 35 m. in average breadth, between New Brunswick and Nova Scotia, Canada. The St. John R. enters the bay on the N.W. side at St. John. At its head the bay divides into two branches —Chignecto Bay in the N.E. and Minas Channel in the E. The rapid rise and fall of tides is noteworthy, the difference between high and low water at Chignecto being over 50 ft.


NEW BRUNSWICK
NOVA SCOTIA
BAY OF FUNDY
ATLANTIC OCEAN
Woodstock
Fredericton
St. John
Moncton
Shediac
Sackville
Amherst
Hillsborough
Hopewell
Hampton
Chignecto B.
Cobequid Mts
Truro
St. Stephen
St. Andrews
Canning
Windsor
Annapolis
Digby
Digby Neck
Halifax
Lunenburg
Liverpool
Yarmouth
Shelburne
Sable I.
Long I.
Brier I.
Mossignol
Minas Channel
Minas Basin
Basin of Minas
Grand Lake
Petitcodiac R.
Memramcook R.
Tantramar R.
Missaguash R.
Gaspereau R.
Annapolis R.
Gaspereau L.
Grand L.
Bedford Basin
Halifax H.
C. Sambro
Mahone Bay
Lahave R.
Port Joli
Port Medway
Northumberland Str.
Prince Edward I.
Charlottetown
Tignish
Pictou
Pictou H.
Canso
Strait of Canso
Chedabucto B.
Musquodoboit
Shubenacadie R.
Shubenacadie Canal
Petpeswick Inlet
Chezzetcook Inlet
Ship Harbour
Country Harbour
Tor Bay
Isthmus of Chignecto
Cumberland Basin
Shepody B.
Petitcodiac
Salmon R.
Jacquet R.
Nashwaak R.
Oromocto
Oromocto L.
Eagletown
Maugerville
Gagetown
Hillsboro
Hillsborough R.
Petitcodiac R.
Memramcook
Dorchester
Tidnish
Nappan
Amherst
Parrsboro
Five Islands
Economy
Advocate Harbour
Cape Chignecto
Cape Sharp
Cape Split
Cape Blomidon
Cape Fundy
Cape Enragé
Cape Tormentine
Cape Jourimain
Cape Tryon
Cape Wolfe
Cape North
Cape Breton I.
Prince Edward I.
Northumberland Str.
Gulf of St. Lawrence
Magdalen Is.
Prince Edward Is.
Grand Manan
Campobello I.
Passamaquoddy B.
St. Croix R.
St. Croix
Digby Gut
Annapolis Basin
Annapolis Gut
Port Royal
Granville
Bridgetown
Middleton
Lawrencetown
Kentville
Wolfville
Grand Pré
Evangeline Beach
Avonport
Horton
Windsor
Truro
Tatamagouche
Pugwash
Wallace
Malagash
Pictou
New Glasgow
Stellarton
Westville
Trenton
Antigonish
Guysborough
Canso
Sherbrooke
Port Hawkesbury
Mulgrave
Arichat
Louisburg
Sydney
Glace Bay
North Sydney
Baddeck
Whycocomagh
Margaree Harbour
Cheticamp
Port Hood
Inverness
Broad Cove
Mabou
Judique
Port Hastings
Strait of Canso
Scatarie I.
Sydney Mines
Little Glace Bay
Lingan
Point Aconi
Point Edward
Point Tupper
Cape Porcupine
Cape George
Pictou I.
Merigomish I.
Malagash Point
Tidnish R.
Nappan
Maccan
Joggins
Joggins Mines
Chignecto Bay
Minas Channel
Minas Basin
Basin of Minas
Cobequid Bay
Cobequid Mts
Economy R.
Five Islands
Parrsboro

phyll, whence follows their inability to assimilate inorganic substances. In the lower forms the threadlike vegetative thallus may consist of a single cell, simple or branched (as in the Moulds). This filamentous cell is a hypha and the whole hyphal mass forms the mycelium or vegetative body the upper part of which, in the higher groups, may constitute a stemlike stroma or thallus, as in the mushrooms. The lowest series, the algal fungi, have a single-celled mycelium, with sexual as well as asexual reproduction. Here belong the species which infest fish and insects, and cause the potato disease and the 'false mildew' of the vine, together with the moulds which grow on bread, cooked meat, and other provisions. In the higher series the hyphæ constituting the mycelium consist of many cells, the reproduction entirely by spores. There are four main groups: — (1) Hemiasci, in which the spores-cases bear some resemblance to those of the next group, but contain an indefinite number of spores; some of the species live in the tissues of host plants, and the yeast fungi also belong here. (2.) Ascomycetes, a large group, chiefly parasitic, with the spores developed in asci, or long tubular cases, each usually with eight spores. Of this group there are three divisions: (*a*) Perisporiaceæ, with enclosed fructification, which is ruptured to free the spores, represented by the mildew fungi and the truffles; (*b*) Pyrenomycetes, discharging the spores from a flasklike receptacle (to which belong *Claviceps purpurea*, the fungus of ergot, parasitic on rye; Cordyceps, parasitic on the larvæ of insects; and *Botrytes bassiana*, which causes the 'muscardine' disease of silkworms; and (*c*) Discomycetes, with the fructification more or less basin-shaped and exposed, as in the cup fungi (*Peziza*) and the morels. (3.) Hemibasidii, the brand fungi, causing smut in cereal plants; the mycelium is converted into spores. (4.) Basidiomycetes, bearing the spores on club-shaped cells. The chief subdivisions are the Hymenomycetes, in which the hymenium or spore-bearing surface is exposed and spread over the laminæ or gills, as in the mushrooms and toadstools; and the Gasteromycetes, in which the hymenium is internal, as in the puff-balls and earth-stars. See Farlow, *Some Edible and Poisonous Fungi, U. S. Dept. Agric., Div. Vegetable Path. and Physiology, Bull.* 15 (1898); Peck, *Rept. State Bot. on Edible Fungi of New York, Ann. Rept. N. Y. State Museum*, vol. 3, No. 4 (1900); Peck, *Mushrooms and their Use* (1897); Marshall, *The Mushroom Book* (1900); McIlvaine, *One Thousand Am. Fungi* (1900); Gibson, *Our Edible Toadstools and Mushrooms*. See MUSHROOM and colored plate.



Fungi, some of which are Destructive to Cultivated Plants.

1. Details of the potato-disease fungus. 2. Mildew of the vine (*Plasmospora viticola*). 3. Mould (*Mucor mucedo*). 4. Yeast fungus (*Saccharomyces cerevisiæ*). 5. Truffle. 6. Smut on barley (*Ustilago segetum*); 6*a*, spores; 6*b*, section of part of grain with smut; 6*c*, Ustilago longissima; 6*d*, Ustilago tragopogonis. 7. Puff ball (*Lycoperdum bovista*).

Fungibles, a term applied in civil law to such things as can be replaced by equal quantities and qualities, such as a bushel of wheat. When such property is loaned it may be consumed and its equivalent returned later under the form of civil-law contract of *Mutuum*.

Fungicides. Substances used to prevent or destroy fungous growths on plants. As with insecticides (which see) the character and application of the substance depend primarily upon the nature of the fungous growth itself, hence some knowledge of fungi is necessary to insure success. For this purpose fungi may be divided into two general classes: those growing within the vegetable tissues on which they feed and those growing wholly on the surface. The first can be successfully treated only during their short flowering period, while the second can be treated at any time. The extension of these injurious parasitic growths has been very marked in recent years owing to

the decline in soil fertility, the increase in fruit cultivation, and the ignorance and indifference of the great majority of farmers. The subject is now attracting wide attention, however, and both the National and State governments are rendering valuable assistance through experiments and by supplying information in regard to these plant diseases and their proper remedies.

The best known fungicides are to be found among the compounds of copper, the most widely used being the *Bordeaux mixture*, which is composed of copper sulphate, lime, and water, in varying proportions. The original formula, as given by Prof. W. R. Dudley, is 16 lbs. copper sulphate dissolved in 22 gallons of water, and 30 lbs. lime dissolved in 6 gallons of water, the two solutions when cool being mixed slowly and thoroughly. This is too strong for some purposes, and modified formulas have been substituted. This mixture is often used in combination with arsenicals, and is applied with a spraying pump.

Copper sulphate is also used with ammonia and water to make the well known fungicide called *Eau céleste*, but this mixture should not be combined with insecticides. The carbonate of copper dissolved in ammonia and diluted with water makes an excellent fungicide.

Potassium sulphide and bichloride of mercury (corrosive sublimate) are both effective, but the former is expensive, and the latter highly poisonous. Sulphur is an old remedy, and may be used dry, in solution, or as a vapor (evaporated over a sand or water bath, not burned). Formalin, or formaldehyde, is used for the prevention of grain smut and potato scab, and hot water for smut in seed grain. See FUNGI; INSECTICIDES.

Bulletins giving instructions for the preparation and use of fungicides may be obtained from the U. S. Department of Agriculture and the Agricultural Experiment Stations. Consult Duggar's *Fungous Diseases of Plants;* Massee's *Diseases of Cultivated Plants and Trees;* Stevens and Hall's *Diseases of Economic Plants;* Heald's *Manual of Plant Diseases* (1926).

Fungus. See FUNGI.

Fungus Beetle, or FIDDLE, a beetle (*Mormolyce phyllodes*), found in Java and the vicinity. Its body, which is shaped somewhat like a fiddle, is about 3 inches long, but so flat it can creep into astonishingly narrow openings. It is often found under bark and behind fungi growing on trees.

Funic'ular, like or pertaining to a funicle—*i.e.*, a rope or cord. The term is applied to rope railways, common in Switzerland.

Funic'ulus, a name given to the stalk by which the ovule or seed is often connected with the ovary wall or partition of flowers.

Funk, ISAAC KAUFFMAN (1839–1912), American author, editor, and publisher, was born in Clifton, O. He was graduated from Wittenberg College (1860), and studied for the ministry at Wittenberg Theological Seminary, Springfield, O. In 1864 he accepted a call to St. Matthew's Evangelical Lutheran Church, Brooklyn, N. Y., resigning in 1872 to travel in Europe, Egypt, and the Holy Land. With A. W. Wagnalls in 1877 he founded the publishing firm of Funk & Wagnalls, and he took an important part in the editorship of *The Standard Dictionary* and *The Jewish Encyclopædia*. In 1876 he founded *The Metropolitan Pulpit* (now *The Homiletic Review*), and later *The Voice* (1880), *The Missionary Review* (1888), and *The Literary Digest* (1889). He was perhaps best known because of his psychic research. He was never a believer in spiritualism in the accepted meaning of the word, but an investigator who brought to bear upon the subject the light of science and the guidance of good sense. He also took an important part in the Prohibition movement. His writings include *The Next Step in Evolution* (1902); *The Widow's Mite* (1904); *The Psychic Riddle* (1907).

Funkia, a genus of Liliaceæ allied to the day lilies (Hemerocallis). Since their introduction from China in 1790, the five or six species have been largely cultivated, not only in greenhouses, but in shrubberies and borders or rockwork. They are handsome plants with bold foliage, often quaintly marked, and with racemes of beautiful large and often fragrant flowers. They are all hardy, and easily grown in ordinary garden soil, preferring that which is rich and deep, and in partial shade. See DAY LILY.

Funnel, in general, any shaft or passage through which light, air, or smoke is conveyed, specifically the smokestack of a steamship. Ships' funnels are constructed of sheet metal, and are of circular or oval section. As a rule, they consist of an inner and outer stack stayed together by long bolts or rivets, and provided with a considerable air space between. The smoke and hot gases from the smoke boxes are conveyed along passages known as uptakes to the inner stack, through which they escape, while the surrounding air space prevents loss of heat by radiation, and thus maintains the gases at a temperature sufficiently high to insure a good draught. An additional casing fitted to the base of the funnel forms a second air space which still further checks radiation, and also aids in the ventilation of the fire rooms. *Funnel guys* of wire rope attached to a band fitted on the funnel at about two-thirds of its height, and secured to the deck or ship's sides, furnish the necessary support in a seaway. Funnels are provided with covers of canvas or other material to protect the interior from moisture when the funnel is not in use, and are fitted with iron ladders to permit access for repairs and other purposes. The height and diameter vary. The height of the funnels of the *Mauretania* is 153 feet from the base line of the ship.

Funnel marks are designs painted on the funnels of steamers to designate their ownership. The funnel marks of the principal transatlantic lines are as follows: American, black funnel with white band and black top; Cunard, red funnel with black rings and black top; French, red funnel with black top; Hamburg-American, buff funnel for express service and black funnel for regular steamers; Holland-American, green, white, and green; North German Lloyd, buff; White Star, buff, with black top.

Funny Bone, the popular name for that point on the elbow, a little to the inner side of it, and at the back, where the large ulnar nerve lies close to the surface in a groove at the back of the lower extremity of the humerus, or bone of the upper arm. When the point of the elbow is struck or rubbed forcibly, the ulnar nerve is irritated with the result that part of the arm and some of the fingers are numbed. See ELBOW.

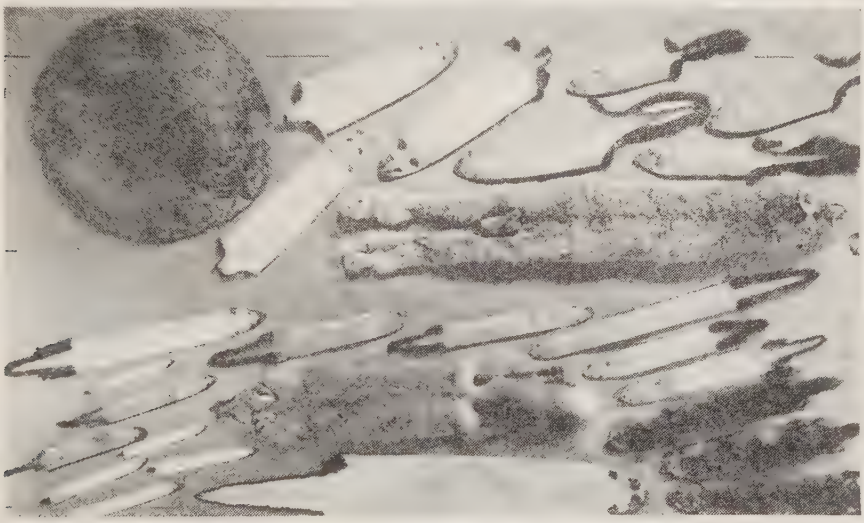
Funston, FREDERICK (1865–1917), American soldier, was born in New Carlisle, O. He removed to Southwestern Kansas at an early age, studied for two years at the State University, and for a short time was engaged in newspaper work in Kansas City. In 1891 he was botanist to the U. S. Death Valley Expedition, and in 1893 was engaged in botanical work for the Government in Alaska. He served with the insurgents in Cuba under Gomez and Garcia in 1896–8, distinguished himself for bravery, and was promoted successively to the ranks of major and lieutenant colonel.

Upon the opening of hostilities with Spain, in 1898, Funston was commissioned colonel of the Twentieth Kansas Volunteers, and sent to the Philippines. In 1899 he was awarded a medal of

honor and promoted to the rank of brigadier general of volunteers for conspicuous gallantry at the battle of Calumpit, where in the face of a heavy fire he established a rope ferry by which the troops were enabled to cross the Rio Grande de la Pampanga. In 1901, having returned to the Philippines to continue the fight against the insurgents, he organized and commanded the expedition which resulted in the capture of Aguinaldo (q. v.), the rebel leader, and for this exploit was commissioned brigadier general in the regular army.

General Funston was placed in command of the Department of California in 1905, and again distinguished himself for the promptness and efficiency with which he used the United States troops under his command during the confusion and incipient lawlessness resulting from the San Francisco earthquake and fire in 1906. He subsequently accompanied William H. Taft, then Secretary of War, on his mission to Cuba (1906); served as head of the army service schools at Fort Leavenworth; and was in command of the Department of Luzon (1911–13), and of the Hawaiian Department (1913–14). He was appointed commander of the Second U. S. Army Division at Texas City in January, 1914, and in April commanded the expedition to Vera Cruz, where he took command after Admiral Fletcher's naval forces had occupied the town; and as military governor (until November, 1914) he instituted important reforms in administration, sanitation, and education.

He was promoted to the rank of major general, Nov. 17, 1914; was made commander of the Southern Department in February, 1915; and was placed in general command of the United States troops on the Mexican border and of United States troops in Mexico in March, 1916. He died, suddenly, at San Antonio, Tex., following an attack of acute indigestion, on Feb. 19, 1917. His body was taken to San Francisco, where it lay in state at the City Hall, and was interred in the National Cemetery at the Presidio.



Courtesy Sears, Roebuck and Co.

PELTS OF VARIOUS FUR-BEARING ANIMALS

Fur, the soft silky covering of many mammals, particularly those indigenous to cold countries. The animal's use of the fur is usually to give warmth, and thus frequently it is found that the winter coat constitutes a much more valuable product than the summer one. A notable example is the weasel, whose winter coat, under the name of ermine, is one of the most costly of furs. For the same reason, as a general rule, the furs which are most prized are those which are obtained from mammals—as the bear and the Arctic fox—inhabiting high latitudes, for it is in these that the coat is densest. But the dense, close fur of the mole is related less to the necessity for warmth than to the protection of the skin from the irritating effects of particles of soil during burrowing. The somewhat similar fur of the beaver has partly, no doubt, a similar function; but more important is its power of throwing off water so as to prevent the chilling of the surface of the skin. The same type of fur, with the same double function, occurs in the Australian duckbill.

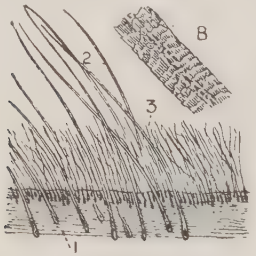
Fur is used both for purposes of dress or adornment and, separated from the skin, for felting in the manufacture of hats. For this purpose the fur of the beaver was formerly largely used, but genuine 'beavers' have been superseded by the silk hat, and by cheaper furs in the manufacture of the ordinary felt. Rabbit fur is principally employed, but 'nutria' from a small South American animal, the coypu, is also used in felting. Many of the furs, used both for felting and for clothing, are really the fine woolly undergrowth of the skin, and in the unprepared skin are mixed with or even covered by a growth of coarser hair. When the hair is to be used for felting, these coarser fibres must first be removed. Ingenious cutting machines are employed for removing the skin, and for sorting the fur according to its fineness. Its felting power is often increased by treatment with a nitric acid solution of mercury. (See Hat.)

The *dressing* of fur skins is a trade the details of which are more or less of a commercial secret. By one method the skins are first treated in a bath of bran,

Fur

alum, salt, and water, to cleanse and preserve the pelt; then washed with soap to remove dirt and oiliness from the fur, and softened by mechanical stretching. (See LEATHER.) Some furs are dressed by drumming with butter and sawdust, and in other cases the two processes are to some extent combined. In the fur seal, the undergrowth of soft fur is covered with one of coarse hair, which is more deeply rooted, and which is loosened by shaving the inner side of the skin till its roots are cut away.

Many furs are *dyed* to improve their color, as in some animals the coloring is not attractive, as for example that of the seal, which is originally a mousy brown.



Fur

A, Section of skin of fur seal; 1, skin 2, coarser hairs; 3, fine fur; B, fur highly magnified.

Most seals were formerly dyed by one firm in London, and the secret of the rich brown required was most jealously kept; but it is said to be produced by repeated treatment with some mixture containing pyrogallic acid. Aniline dyes are also produced specially for fur dyeing. Until the outbreak of the Great War London was the best place for dyeing seal skin; Germany for Persian lamb, fox and squirrel; France for black rabbit and musquash; and Belgium for fancy dyes. But at the present time the United States has arisen as a strong competitor to England.

Many of the most important furs are derived from small animals of the weasel tribe, such as ermine, mink, sable, and marten. The more expensive furs are, of course, imitated in cheaper skins; and many furs (as nutria and skunk) are known, when finished, by fancy names which have no relation to the animal from which they are obtained.

Fur Industry.—The fur trade is of prehistoric antiquity in Asia, while it first appeared in Europe about the sixth century, when sable skins were brought to Rome. Italian traders introduced Asiatic furs into Western Europe, but for centuries their use was confined to persons of wealth, and restricted by law: royal personages reserving certain kinds, such as ermine, and nobles of various ranks or religious orders keeping to themselves some other sorts. This rarity and exclusiveness was changed by the brisk traders who took advantage of the development of navigation and commerce following the geographical discoveries of the fifteenth and sixteenth centuries, since furs could then be brought more and more cheaply and unrestrictedly from Russia and the Far East, and the opening of America to trappers and traders offered an apparently inexhaustible supply of excellent furs at steadily lessening prices. Aristocratic restrictions could not withstand the combined abundance and cheapness of an article universally required for comfort as well as display, and the use of furs rapidly became general in all the varied forms of robes and garments now familiar.

At first, indeed, the whole value of North America, apart from its coast fisheries, seemed to consist in the skins that could be obtained, and early commerce and colonization, with the exception of the settlement of New England, had this primarily in view. So fierce became the rivalry between the fur traders that open warfare was repeatedly waged between communities, especially in the north, where the English monopoly of the Hudson Bay Company was incessantly resisted by the French traders of the St. Lawrence valley, until their quarrels took on an international aspect. It is mainly due to the enterprise and efforts of the fur traders that the northern interior of the American continent was explored at an early date, and the general value of its resources ascertained, so that immigration was stimulated and civilization rapidly brought about.

The enormous amount of furs sent to Europe from Canada during the seventeenth and eighteenth centuries is almost beyond belief, and at the same time constantly increasing supplies were furnished by Asia. The result was a general use and cheapness far greater than at present, when furs of the better sort have again become a luxury, and several sorts formerly most widely worn and highly esteemed—especially seal, beaver, otter, and bison robes—are exhausted, or nearly so. On the other hand, the last few years have seen a tremendous demand for fur both for garments and trimming, with the result that research has discovered many different dyes to be used on the same skin to produce so-called different furs.

The great fur markets of the world are London and Leipzig in Europe and New York in America. Thither the supplies tend from all parts of the globe, and auction sales are held periodically which everywhere regulate the market price of furs. This is especially true of New York and London, whither go the larger part of the world's product, and whence are obtained current prices, in the fluctuation of which changing fashions exert a greater influence than scarcity or plenty.

In recent years the United States has become the chief centre of the fur industry of the world, and at present (1940) in New York City more raw skins are made into furs, and more furs fashioned into garments, than anywhere else.

Skins.—Perhaps the most important of the fur skins is that of the seal. This animal, formerly so prevalent in the Pacific Ocean, was rapidly becoming exterminated by its reckless slaughter by hunters seeking its skin for furs. In consequence, an Act of Congress, approved Aug. 24, 1912, provided that all killing of fur seals within the jurisdiction of the United States in Alaska should be stopped. This applied chiefly to the rookeries on the Pribylov Islands, where in strict compliance with the provisions of the law no seals were killed except such as were necessary for food for the natives. (See SEAL FISHERIES.) In consequence of this law, the herd which in 1912 consisted of 215,738 individuals, has been increased to about 400,000 individuals in 1927.

Other important furs are bear, which are used more especially for rugs; beaver, a soft dense fur used in the manufacture of hats and for small fur garments and trimming; ermine, perhaps the most celebrated fur in the world, the winter dress of the stoat, a fierce little animal of the weasel family whose pure white winter coat is one of the most costly of all furs; fox, of which there are many varieties, a lovely and exceedingly popular fur for trimmings, stoles and scarfs; lynx, a long, soft, silky black fur resembling fox, but less durable; marmot, one of the cheaper varieties of fur used as a lining and for trimming; marten, somewhat resembling sable but less costly; mink; mole; nutria; rabbit, sold under many names but rarely under its true one; raccoon, much used for coats and sport wear; squirrel, a soft delicate fur, formerly much used for lining but now popular for coats and trimming; and wolf, a handsome fur with excellent wearing qualities.

Courtesy Fromm Bros., Inc., Hamburg, Wis

SILVER FOXES IN A TIMBERED SECTION OF A LARGE FUR FARM

Courtesy Fromm Bros., Inc., Hamburg, Wis.

SILVER FOX PELTS READY FOR MARKET. THE ANIMALS WERE RAISED ON A FUR FARM

Trade Names.—Many of the popular furs are sold under names that are not correct, among which the following are the most common misnomers: American sable is sold as 'real Russian sable'; dyed fitch as 'sable'; dyed goat as 'bear'; dyed hare as 'fox'; kid as 'lamb' or 'broadtail'; dyed marmot as 'mink,' 'sable,' or 'skunk'; dyed mink as 'sable'; dyed musquash as 'mink' or 'sable'; pulled and dyed musquash, pulled and dyed nutria, and sheared and dyed rabbit as 'seal,' 'electric seal,' 'Red River seal,' and 'Hudson seal'; pulled natural nutria as 'beaver and otter'; sheared and dyed opossum as 'beaver'; pulled and dyed otter as 'seal'; dyed rabbit as 'sable' or 'French sable'; white rabbit as 'ermine'; white dyed rabbit as 'chinchilla'; dyed wallaby as 'skunk'; white hare as 'fox.' In addition, white hairs are inserted in foxes and sables to make 'silver fox.'

Statistics.—The U. S. Census of Manufactures for 1937 reported 121 establishments engaged in the dressed fur industry, employing an average of 6,343 wage earners, with products valued at $21,762,887. Of these establishments 74 were located in New York, and 21 in New Jersey. For the calendar year 1935, the Bureau of Foreign and Domestic Commerce reported exports of furs and fur manufactures valued at $16,792,000, and imports of furs and fur manufactures valued at $53,161,000. There are about 1,642 firms manufacturing furs in the United States, employing about 13,000 people.

See separate articles on the animals and furs mentioned, as BEAVER; COYPU; ERMINE, FOX; MARTEN; MINK; OTTER, SABLE; SKUNK; WEASEL.

Bibliography.—The literature on this subject is scattered through the reports of the U. S. Bureau of Fisheries, especially the annual Alaska Fisheries and Fur Industries and the Daily Consular and Trade Reports of the Bureau of Foreign and Domestic Commerce. Consult also Laut's *The Fur Trade of America* (1921); Ahern's *Fur Facts* (1922); Sachs' *Furs and the Fur Trade* (1923).

Furcræa, fûr-*crē'a*, a genus of tropical American succulent plants belonging to the order Amaryllidaceæ. They sometimes live for a long number of years before flowering, and after fruiting die.

Fur Farming, the breeding and rearing of fur-bearing animals for commercial purposes. The growing scarcity of fur-bearing animals has been partially met—apart from the seal industry—by the establishment of a new and fast growing industry, that of fur farming, which has received substantial aid from the Bureau of Fisheries and the U. S. Biological Survey. The U. S. Department of Agriculture maintains an experimental fur farm in Saratoga County, N. Y., where careful research work is carried on. A conspicuous illustration of this industry is to be found in the fox herds of the Pribylov Islands, where the blue fox has received protection similar to that given the seal. This animal, which is a dark slate or brown phase of the Arctic or white fox, has been propagated satisfactorily on several of the Alaskan islands. Some success with blue foxes has also been attained on Prince Edward's Island. The fur is nearly five inches long, very fine and thick, and therefore valuable.

Breeding silver foxes has been successfully carried on for a number of years on Prince Edward's Island and elsewhere in Canada, as well as in several of the more northern of the United States. The silver fox is the progeny of a pair of red foxes in which the red hairs of the upper parts are entirely replaced by black, while the white hairs remain as usual. The pelt of the silver fox has a beautiful sheen and fineness and is difficult to imitate so that as a result it has a high market value and finds a ready sale.

Skunk skins are readily marketed and as this animal is quickly tamed, is gentle, and easily managed, there are a large number of skunk farms in the United States. Experts find it easy to remove the offensive scent glands; and as the skunk remains in its den during the severe winter months, it is easily cared for. The fur is of medium length, erect, and possesses a brilliant sheen. Good skins command an average value of $4. It is estimated that the value of the skunk skin industry in the United States amounts to over $3,000,000 a year.

Minks are bred in the United States for their skins, the industry being only slightly less in value than the skunk industry. Mink fur is short, but very thick and soft, and ranks among the most durable of furs. During the decade ending with 1925 the average price of a good skin was about $10.

The muskrat, while not as yet domesticated to the same extent as the skunk and mink, possesses a valuable fur that is dense and soft, resembling the fur from the beaver, but possessing a shorter and less close pelage. Many are raised on privately owned marshlands in New Jersey, Delaware, Maryland and Louisiana.

In addition to the foregoing, the American marten, fisher marten, and otter have been partially tested for domestication but thus far breeding of martens or fisher martens in captivity has met with slight success. Rabbits are raised successfully for both meat and fur and this industry is especially successful in the Pacific States.

The development of the karakul sheep in the United States has been fostered by the Bureau of Animal Industry, under whose supervision efforts have been made to produce a breed of sheep similar to the original karakul, or Persian lamb, which comes from Central Asia, chiefly from Bokhara. The particular value of the fur is due to the curl, and according to the character of the curl the fur is known as Persian lamb, Astrakhan, or Broadtail. In the past, the great market for this fur has been the summer fair at Nijni-Novgorod.

There are about 2,500 fur farmers in the United States and Alaska, and about 1,500 in Canada, the majority of whom raise blue and silver foxes.

Furfural, fûr'fū-rāl (Furfurol, Furfuradehyde, Pyromucic aldehyde), C_4H_3OCHO, the aldehyde of furfurane, obtained by the action of dehydrating agents on carbohydrates, such as bran, grain, etc. It is a colorless (b.p. 161° c.) oil of a pleasant aromatic odor, which turns brown on exposure to light, the change taking place more rapidly in the anhydrous than in the commercial product. By distilling the latter in a vacuum and discarding the first portions distilling over, as well as the last, a pure colorless product is obtained which is stored in amber bottles. It occurs in beer and spirits, from which it is removed without great difficulty.

Furfural is being produced on quite an extensive scale from oat hulls by the action of steam and acid in rotary digestors.

In its chemical properties it behaves very much like benzaldehyde. A large series of synthetic resins has been prepared and is attaining considerable commercial importance, particularly the phenol-furfural resins which are somewhat like the phenol-formaldehyde resins(*bakelite*).

Furies, or FURLAE. See EUMENIDES.

Furka Pass, a pass leading from Goeschenen (at the northern mouth of the St. Gothard Tunnel), in the Swiss canton of Uri, up the Reuss valley, past Andermatt, to the extreme head of the Rhone valley, close to the source of that river in the great Rhone Glacier. See ALPS.

Furlong. This measure of length, now representing one-

eighth of a mile, was originally the length of the ancient acre, which had a definite form, being 40 rods in length by 4 rods in breadth. On the old English open or common field system, each furrow ploughed ran the length of the acre, and the distance was called *furlong* ('furrow-long').

Furlo Pass, tunnel through the Apennines in Italy, on the ancient Via Flaminia from Rome to Fano, constructed by the Emperor Vespasian in 77 A.D. It is 17 feet wide, 14 feet high, and about 120 feet long.

Furlough, the authorized absense of enlisted men and noncommissioned officers in the army; sometimes applied also to similar absences from duty in civil life. In the U. S. army furloughs of three months may be granted by post commanders, and by brigade and district commanders to men under their immediate control; furloughs of one month may be granted by commanding officers of general hospitals, general depots of supply, mine planters or by regimental commanders, if the companies to which the men belong are under their control. The chief of a War Department bureau may grant furloughs not to exceed three months to enlisted men of his corps or department serving under his exclusive control. An enlisted man on furlough may not leave the United States to go beyond the sea unless specially permitted to do so, and the number of men on furlough from any command must not exceed 5 per cent. of the enlisted strength. Soldiers on furlough are entitled to pay and to commutation of rations at the rate of 30 cents a day.

The term furlough is applied to officers of the British army on foreign service but not to officers in the United States army. Consult *Regulations of the Army of the United States.*

Furman University, a Baptist educational institution at Greenville, S. C., founded in 1851 as successor to the Furman Academy and Theological Institution, established in 1826. It has collegiate and law departments. For recent statistics see Table of American Colleges and Universities under the heading COLLEGE.

Furnaces, devices for the useful application of heat produced, as a rule, by the combustion of fuel, but of late years also by the conversion of electrical energy. In modern usage the term furnace is applicable only to warm-air heaters, the term boiler being used for the central heater in steam and hot-water heating systems.

The modern warm-air furnace is either a cast iron or steel heater enclosed in a casing of galvanized iron of double thickness. The air is warmed in the area between the heater and the casing and then enters pipes. Almost any fuel can be used, coal either bituminous or anthracite, gas, oil, or coke. The method of draft operation and firing is similar to the water boiler. At the base of the furnace is a large duct through which the cooled air is delivered from one or more points on the first floor. These are usually located in halls, living rooms or other sites, where the normal circulation of the air would indicate them. The cooled air, by reason of its heaver weight, flows to floor level and then through the grill covering a cold air return. It passes to the furnace, is forced against the heated surfaces and warmed, and then rises through the warm air pipes to the rooms in the house.

The modern furnace is designed for complete combustion, and has flanges with deep corrugations to increase the amount of heat-radiating metal over which the air currents pass. There is a water fan from which constant evaporation of water moistens the warm air before it passes up into the house.

By means of an electrical thermostat regulated by a clock the furnace can be operated from a central point in the house so that no attention is necessary other than regular firing. Where gas and oil are used, the automatic thermostat has made it possible to disregard the furnace during the entire heating season. In such cases the thermostat will maintain any desired temperature both day and night through automatic regulation. See FUEL; HEATING.

Electric Furnaces may be divided into three groups—resistance, arc, and induction furnaces. Low-temperature furnaces or ovens are usually of the *resistance type.* They consist of an enclosing box or case of heat-insulating materials, with resistance strips distributed over the inner walls and supported on suitable refractory supports. Current (either alternating or direct) passed through these resistance strips heats the strips and hence the oven. Such furnaces are used for baking foods, making enamelled ware, impregnating compounds, and annealing. They range in size from a few inches to twenty feet or more in each dimension. The only limit to the temperature obtainable is the fusing point of the materials used for the resistance units, supports, and walls. The electric current supplies energy at a steady rate, and the temperature rises indefinitely until the loss of heat through the walls equals the rate of energy input. By properly proportioning the energy input and the heat losses, any temperature may be attained.

Several advantages are offered by these furnaces over fuel-fired furnaces. No contamination of the contents can occur from contact with the combustible material or the products of combustion. The temperature can be much more accurately controlled. Automatic devices may be used which control the energy input so as to hold the temperature constant within a small fraction of a degree centigrade. All the furnace contents can be heated more uniformly, with no hot or cold spots, than is usually the case with fuel-fired furnaces.

A special type of resistance furnace is the carborundum furnace. It is of very simple character, the materials being piled on a firebrick bed from 20 to 30 feet long around a semi-conducting core of pieces of carbon, which form the connection between the carbon poles, to which the cables conveying the current are connected. The heap is built round by loose bricks, which allow the escape of gaseous products, the heat being generated by the resistance of, and the arcs between, the pieces of carbon.

Arc furnaces are used where higher temperatures are required, as for the melting of metals, the temperature limitation imposed by the fusing point of the resistance element being removed by using an arc from carbon electrodes as the resistance element, and permitting the electrodes to be slowly consumed. An arc furnace consists of a vessel or hearth to hold the charge, with two or more electrodes suspended above the surface of the charge. Alternating current at 50 to 100 volts pressure is led in at one electrode, through an arc to the material of the charge, through another arc from the charge to the second electrode, and out from this electrode. In some forms, a single electrode and single arc are used, the current being led out through a submerged terminal in contact with the charge. In other forms, three electrodes are employed, connected to a three-phase supply, the arc passing through successive pairs of these three, and changing from pair to pair many times a second. Alternating current is used to avoid the electrolytic action of direct current. Delicate and sensitive automatic control devices are required to support the electrodes at the proper height above the surface of the

charge to maintain the arcs, as these must be instantly moved up or down to follow all fluctuation in the metal surface or in the intensity of the arc. Also, in first forming the arc, the current will not jump across a cold air space. To start, the electrodes are automatically lowered into contact with the charge; when the current flows they are automatically raised to the proper distance, thus forming the arc.

The advantages of the resistance type of furnace are secured in large measure with the arc type, also. Contamination, due to the fact that the atmosphere is more difficult to seal out, and that the material (usually carbon) of the electrodes may get into the charge in small quantities, is negligible as compared with ordinary fuel-fired furnaces. Arc furnaces are widely used for the melting of iron and steel, where close control of the constituents or temperature is desired.

An *induction furnace* resembles a transformer. It consists of a primary coil wound around an iron core, and supplied with alternating current of from a few hundred to several thousand volts. The vessel containing the charge is in the form of a ring or loop, either horizontal or vertical, also surrounding the core. The alternating primary current sets up an alternating magnetic flux in the core, which in turn induces an alternating voltage in the material of the charge. If the charge completely fills the loop, which is a necessary condition, the induced voltage will push a current through it around the loop, which heats the charge. The action of this current is like that in a resistance furnace, except that the charge itself is the resistance unit. Because of the loop form, the radiating surface exposed is large, and it is, therefore, somewhat difficult to reach extremely high temperatures. Also the cost of the refractory lining is relatively high, because of the amount needed. An advantage is that the charge can be well shielded from contamination. Induction furnaces are widely used in the melting of brass, zinc, and copper. In operation these furnaces must never be emptied to a point where the loop is broken, for there would then be no path for the secondary current, and the furnace could not be restarted. The original starting is done by filling with molten material from another furnace.

Electric heat is inherently and fundamentally more expensive than the same amount of heat from fuel, but the prevention of contamination and the accuracy of temperature control frequently justify its use. Furthermore, the directness of application and better heat insulation permitted sometimes enable the reaching and maintaining of a given *temperature* with so many less *heat units* that the actual cost of the heat required is no greater than with fuel or may even be less.

Ordinary induction furnaces perform better if designed for frequencies below the usual values of 25 to 60 cycles. Hence they are sometimes designed for 16 cycles or less, and supplied from special sources. If the frequency, on the other hand, is increased, the iron core becomes less important, and at several thousand cycles it may be dispensed with. The Northrup furnace consists of a simple cylindrical or cup-shaped crucible, surrounded by a primary winding, with no iron core. The primary is supplied with alternating current at several thousand cycles. The elimination of the iron core does away with the necessity for the loop form of the crucible. This permits better heat insulation, higher temperature, more effective sealing against contamination. This type of furnace is used for the production in small quantities of pure alloys of high grade.

Electric furnaces of any of the types described must be distinguished from those in which electrolysis takes place, as in the preparation of aluminum, and which are electrolytic cells rather than furnaces. Such cells may be distinguished by the fact that they work only with direct currents and not with alternating, which are as effectual or even necessary for electric furnaces proper.

See ELECTROCHEMISTRY; ELECTROMETALLURGY. Consult Rodenhauser, Shoenawa and Vom Baur's *Electric Furnaces in the Iron and Steel Industry* (1920); Stansfield's *The Electric Furnace* and *The Electric Furnace for Iron and Steel* (1923).

Furneaux, TOBIAS (1735–81), British navigator and explorer, was born in Swilly, near Plymouth, England, and entering the British navy, saw service, during the Seven Years' War, off Africa and the West Indies. He accompanied Captain Samuel Wallis as his second lieutenant on the voyage of the *Dolphin* around the world, and on Captain Cook's second voyage commanded the *Adventure*. This ship became separated twice from the *Resolution*, commanded by Cook. During the second separation (October 1773–July 1774), Furneaux explored and mapped the southern and eastern coasts of Tasmania to the satisfaction of Cook, who went over the ground again during his third voyage. In June 1776, Furneaux commanded the *Syren* in the attack on Charleston, S. C.

Furneaux or FLINDERS ISLANDS, a group in Bass Strait, between Tasmania and Victoria, Australia. The chief is Flinders, or Great Island (35 by 10 miles), the others being Cape Barren, Clark, Hummock, and Babel. They are mostly barren, and were named after Cook's lieutenant, Tobias Furneaux (q. v.), who discovered them in 1773.

Furness, peninsula of North Lancashire, England. Rich beds of hematite iron ore were known and smelted at Walney in ancient times, and have led to the rise of the town and docks of Barrow. The ruins of Furness Abbey (founded 1127), near Dalton, are among the most interesting and picturesque in England, especially the Norman arches at the entrance to the chapter house. There are two effigies of Norman knights in Abbot's Chapel. The abbey was of Cistercian foundation.

Furness, HORACE HOWARD (1833–1912), American Shakespearean scholar, son of William Henry Furness, a leading Unitarian clergyman, was born in Philadelphia, Pa., and was graduated from Harvard (1854). He travelled and studied in Europe during 1855–6, receiving the degree of PH.D. from Halle, and on his return to Philadelphia studied law and was admitted to the bar in 1859. He was a member of the Seybert commission to investigate modern spiritualism but is best known for his Shakespearean studies which materialized in his *New Variorum Edition of Shakespeare*, which, as he noted in the preface to the first volume, *Romeo and Juliet* (1871), was the first variorum edition of the poet since that edited by Boswell's son and published in 1821. As originally planned, the text used as the basis for Dr. Furness' edition was to be the reading of a majority of the ablest editors, but in 1886 the text of the First Folio was adopted for future volumes. *Romeo and Juliet* was followed by *Macbeth* (1873), *Hamlet* (1877), *Lear* (1880), *Othello* (1886), *The Merchant of Venice* (1888), *As You Like It* (1890), *The Tempest* (1892), *A Midsummer Night's Dream* (1895), *The Winter's Tale* (1898), *Much Ado About Nothing* (1899), and *Twelfth Night* (1901), *Love's Labour's Lost* (1904), *Anthony and Cleopatra* (1907), *Cymbeline* (1913). Although all of Dr. Furness' conclusions, as set forth in his prefaces and notes, have not received the acceptance of other scholars, his industry and general judgment

in collecting the views of the best critics have been highly praised. In this work he was assisted by his wife, author of *A Concordance to Shakespeare's Poems* (1874), and by his son, H. H. Furness, Jr. (q.v.). He was a member of the American Academy of Arts and Letters. He edited the correspondence between Ralph Waldo Emerson and William Henry Furness, under the title *Records of a Lifelong Friendship* (1910).

Furness, HORACE HOWARD, JR. (1865–1930), American Shakespearean scholar, son of H. H. Furness (q.v.), was born in Philadelphia. He was graduated from Harvard University in 1888, and was instructor in the Episcopal Academy, Philadelphia, from 1891 to 1900. He was a member of the National Institute of Arts and Letters. He assisted his father on the *Variorum Shakespeare*, and continued that work after his father's death. He has edited *Macbeth* (1903); *Richard III.* (1908); *Julius Caesar* (1913); *King John* (1920); *Coriolanus* (1928).

Furness, WILLIAM HENRY, JR. (1828–67), American portrait painter, brother of H. H. Furness (q.v.), was born in Philadelphia, and began to study art at the age of seventeen. Later he removed to Boston, where he specialized in crayon drawing, and made portraits of distinguished people. Afterward he went to Düsseldorf, and studied painting under Leutze. On his return to Boston he devoted himself to painting in oils, and met with marked success. Notable examples of his work are the portraits of his father, of Lucretia Mott, and of Charles Sumner.

Furness, WILLIAM HENRY 3D (1866–1920), American ethnologist, son of H. H. Furness (q.v.), was born in Wallingford, Pa. He was graduated from Harvard University in 1888, and from the University of Pennsylvania Medical School in 1891. He travelled extensively, and devoted special attention to the study of folklore, and to the psychology of the anthropoid apes. From 1904 to 1906 he was secretary and curator of the Free Museum of Science and Arts, University of Pennsylvania. His writings include *Folklore in Borneo* (1899); *Life in the Luchu Islands* (1899); *Home Life of the Borneo Head-Hunters, Its Festivals and Folklore* (1902); *Uap, the Island of Stone Money* (1910).

Furni Islands, fo͞or'nē, a small group of islands in the Grecian Archipelago, southwest of Samos. The largest is Furni (10 square miles), the only one inhabited.

Egyptian Folding Stools

Fur'niss, HARRY (1854–1925), English caricaturist, was born in Wexford, Ireland. He was for many years a contributor to *The Illustrated London News, The Graphic, Black and White, Illustrated Sporting and Dramatic News*, and other English and American publications. In 1880 he joined the staff of *Punch*, where his illustrations of the Parliamentary section were especially popular. He left *Punch* in 1894, and started the publication of *Liko Joko* and the *New Budget*, both of which were short lived. He lectured in Great Britain and the United States on 'Arts and Artists,' 'Humors of Parliament,' 'Harry Furniss at Home,' and other subjects. He illustrated Burnand's *Incomplete Angler* (1887); Carroll's *Sylvie and Bruno;* Davidson's *Fleet Street Eclogues;* Lucy's *Diary of the Salisbury Parliament* (1892); and complete works of Dickens (1910) and Thackeray (1911). His writings include *Romps* (1885–6); *Royal Academy Antics* (1890); *P. and O. Sketches* (1898); *America in a Hurry* (1900); *Confessions of a Caricaturist* (2 vols., 1901); *Poverty Bay* (1905); *How to Draw in Pen and Ink* (1905); *Our Lady Cinema* (1914); *Going! Going! Going!!—Political Sale Catalogue* (1914); and numerous motion-picture plays, in which he himself appeared.

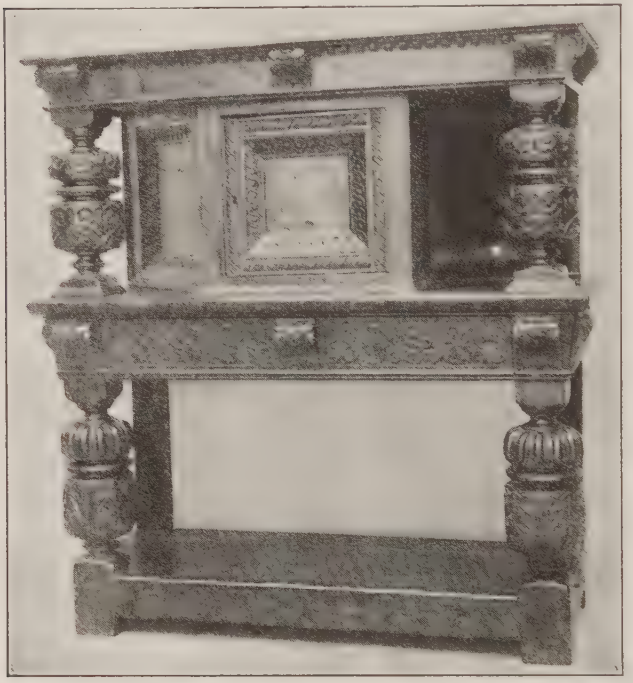
Furniture, a word in its most restricted sense denoting the movable articles employed for use and comfort in a dwelling house, especially cabinet makers' work, such as beds, tables, chairs, bureaus, and desks.

The history of furniture is intimately affiliated with the history of man. Its inception sprang spontaneously from the needs of primitive peoples who supplied their crude caves and huts with beds of flattened stones, logs, or boughs, which rudimentary inventions became the potential bed, chair and table of modern times. Furniture arouses interest, first of all, for its usefulness, and then for its beauty and historic significance. We feel its human quality, and through its shape and decoration, we can trace the influences of a prevailing architecture, of distinguishing forms in nature, of social customs and manners and even the political life of the times.

The materials from which it is fashioned vary according to the resources and tastes of different countries and climates. The number of objects used by all early peoples, whatever the degree of their civilization, was very limited—a chest, table, chair, and couch being the sum total of their household furniture. A warring, roving, outdoor life calls for but

Furniture

the simplest forms of comfort, and only those objects that could be easily packed and carried away were considered essential for man's estate. These conditions continued until the end of that epoch, known in history, as the Middle Ages. But a more settled life and the growth of peaceful habits quickened the development of furniture making. From the few resplendent, massive pieces enjoyed only by royalty or the very wealthy, it grew simpler and less heavy, less expensive and greater in numbers, until the day dawned when chairs and tables and beds became the ordinary plenishings of every household.



English Court Cupboard of Oak, 16th–17th Century

Of primitive furniture nothing remains. The rare examples taken from Egyptian tombs, or the sources of information gathered from pictures and sculptures, dating from about 4000 B.C., all reveal a highly specialized craft that was the result of long ages of furniture development. Egyptian stools, benches, couches, chairs, tables, were made of wood, metal and stone—the wood being mainly cedar, acacia, or sycamore, inlaid or vencered with ebony, mother of pearl and ivory, and decorated with carving, painting, gold, silver and even precious stones. Wood was, and ever has been, the most favored material for furniture construction, for it has always been easily procurable, affords greater variety and lends itself readily to decoration. The coverings of Egyptian furniture were sometimes fashioned from the most splendid textiles that were supported upon the carved legs of wild animals. Color was brilliant and daring, forms graceful and well constructed, certain types of which remain to us, having been handed down through succeeding periods of furniture making. Seats were often of solid leather or fashioned from plaited rope and rush, softened by the use of mattresses and cushions. Many fine examples have been preserved due to Egypt's dry climate and the custom of filling tombs with the possessions of the deceased.

Assyrian and Babylonian furniture was similar in form to the Egyptian, equally resplendent, though less graceful and refined. Tables and couches were made from cedar, cypress and ebony, elaborately inlaid with ivory and precious metals, or decorated with carvings of the winged bull, the lion and ram. Human figures, representing prisoners, were debased as humble supports for thrones and tables.

Greek furniture, though inheriting many Oriental qualities, possessed fundamental beauty and simplicity of line and restraint in ornament, which characterized its architecture as well. Perhaps Greek design, more than any other, has been the greatest source of inspiration for succeeding ages. Many pieces were constructed from wood—the olive, cypress, yew, oak, box—but the most arresting examples are of those of bronze, damoscened with gold and silver or other metals.

The typical Athenian home was studiously simple until the last three centuries before the Christian Era, when living became luxurious and sumptuous. The Roman arts were but an elaboration of those created by the late Greek artists, and Roman craftsmen used gold and silver profusely for inlaying, and precious stones for embellishment. Couches and tables were carved from slabs of marble, and those objects made from wood were ornamented with tortoise shell and ivory, and sometimes decorated with paintings and veneer. This was the age of great luxury and all living appurtenances reflected its richness and splendor. A mixture of Roman and Eastern styles that was really a corruption of the early classic Greek, developed into what is known as Byzantine. The ornament upon its wooden and metal furniture was very profuse, ivory being a favorite material that was used effectively either as carving or inlaying, and enamelling and gold damoscening gave scope to the craftsman for very elaborate design.

With the fall of Rome 476 A.D., the brilliant luxury-loving life of Classic days was followed by the turbulent, violent period of the Middle Ages. It was the age of feudalism, war and chivalry—a chaotic time hardly conducive to

Folding Chair of Walnut, Inlaid with Certosina work of Ivory and Metal; Early Italian Renaissance

FRENCH CABINET OF WALNUT, RICHLY CARVED AND GILDED; 16th CENTURY

Furniture

any progressive development in the domestic arts, yet they managed to survive, and furniture that still played a necessary part in the carrying on of the household, was still produced for those of high estate. There were two distinct styles that influenced

Sixteenth Century Florentine Cabinet of Walnut

furniture design at this time. The Byzantine, a debased mingling of the Roman and Oriental, and the Romanesque, a fusion of the North and South exemplified in German and Latin civilizations. Naturally, practically nothing remains of those violent days, but explicit knowledge, gleaned from existing Romanesque illuminated manuscripts and Byzantine Church mosaics, shows that furniture was massive and heavy, decorated with carvings and ornamented with enamalling and mosaics. There are, however, three precious and important relics that still exist: The throne chair of St. Peter at Rome dating from about the fourth century, is architectural in form, made of wood and ornamented with carved ivory, inset as panels. The Maximian chair at Ravenna, of simpler form, is a product of the sixth century—its surface almost hidden by intricate ivory carvings. Constructed a hundred or more years later, and before the reign of Charlemagne, King Dagobert's chair preserved in the Louvre in Paris, shows an open framework in gilt bronze with legs shaped like lion's heads and paws. It is the only specimen known belonging to this period.

Little is known of furniture attributed to the tenth to fourteen centuries except what can be gathered from old missals and manuscripts. The designs of State furniture in Italy and France and those countries under the dominion of Carlovingian rulers were Byzantine in character, gilded and painted. In northern Europe, furniture of this kind was made of oak and carved, and the earliest oak chest dates from this period.

After the Norman invasion, times became more settled, and the domestic arts profited by this quieter influence. Chests were more elaborately carved with panels of tracery, strongly built with iron bandings and heavy iron locks, that made them safe to carry tapestries and valuable goods from one stronghold to another. Bedsteads consisted of wooden frames with richly carved posts and testers, upon which handsome stuffs and elaborate tapestries were hung. Wall tapestries were the chief splendor of feudal castles and homes, and, as highly valued possessions, they could be packed in chests and carried from place to place.

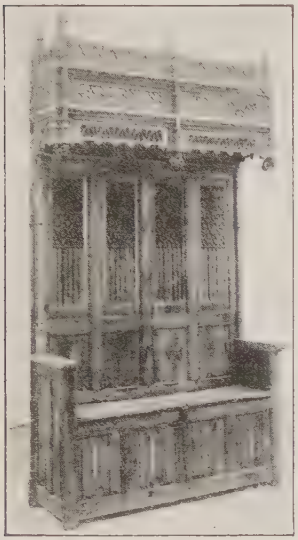
From 1216 to 1272, wooden paneling was first introduced upon interior walls, and a few hundred years later, the best period of mediæval art found expression in England, Flanders and France, when the Gothic or Pointed style (extending from 1100 to 1550) symbolizing the ardor and spiritual significance of religious feeling, became the great æsthetic impulse that dominated and inspired builder, sculptor and wood carver alike. All the arts fell under the same spell, and the designer who planned cathedrals and monasteries planned their furniture as well. This was essentially architectural in character, and naturally domestic furniture took on the same quality. The linenfold and tre-foil patterns, the best known designs, Flemish in origin, became identified with this period and they appear upon the wall panels and furniture of all countries influenced by this same inspiring impulse. Outside of ecclesiastical forms, leaf motifs were the predominating Gothic characteristic in ornament, though there were many other variations. French Gothic was bold and elaborate, and floral leaves were made rounder and fuller than the English. French Gothic furniture was of high excellence, elaborate and beautifully executed in detail when for royal or noble use, but of a simple type for the ordinary house. The Netherlands was influenced by France and Germany, the latter followed the Vertical Gothic developing an intricate strapwork design. German wood carving of the fifteenth century was famous for its beautiful craftsmanship and rich designs. The late English Gothic, with a mingling of Italian and Flemish ornament, developed finally into the style known as 'Tudor.'

American Oak and Pine Chest, 17th Century

In Italy, until the latter part of the fifteenth century, design was a mixture of the Byzantine and Gothic. But about this time there arose the most dis-

Furniture

tinctive epoch in the history of art—the brilliant revival of Classic civilization known as the Renaissance, which had its birth in Italy, but which spread throughout Europe arousing everywhere a fresh interest and impetus in science, literature and art. Though it reached its finest



Flemish Canopied Seat of Oak (Gothic)

flowering in Italy, all the countries in Europe were deeply influenced by this return to classicism, and mingling as it did with native art, each country kept something of its own individual style, so that we speak distinctively of the Italian, French, English, German and Spanish Renaissance.

In Italy many famous palaces were built and furnished, and the geniuses of this age expended their great talents not only upon architecture, painting and sculpture, but upon the most subordinate details. They were both artists *and* artisans, and the things of every day life were exquisite in design and finish. The furniture of the early Renaissance period was simple and dignified, usually rectangular and architectural in form, decorated by plain mouldings, or panelings or by harmonious carvings, paintings and intarsia. Some of the early chairs were in the form of a folding stool, or there was the curule or cross-legged chair, both types of Roman descent. There were other simple, straight chairs with rush, leather or wooden seats having ornamented backs and carved front stretches.

The early chests in the shape of long, low boxes with hinged lids, for holding clothes, velvets, or embroideries, were indispensable pieces of furniture in those days. They were also sometimes used as benches to sit on, or as tables, or steps for very high beds. These were not as elaborate as the 'bridal chests,' which were rich in gold and silver, decorated with reliefs in gesso, or painted by some famous artist.

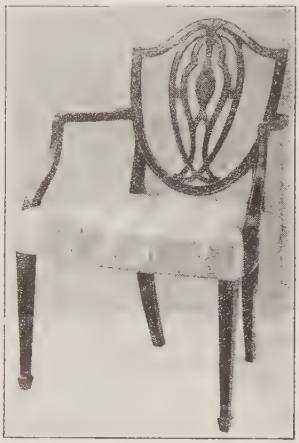
In the second or culminating period of the Renaissance, furniture became more formal and more elaborately decorated and sumptuous in form, to accord with its palatial surroundings. Architectural motifs predominated, and columns, pilasters, and cornices were used with carvings in high and low relief. The human figure was introduced as a constructive element, generally utilized in the place of fluted or carved columns—and coverings and hangings were of rich velvets, brocades, silks and tooled leather, finished with heavy cords, tassels, and galloons or with rows of brass-headed nails. Metal enrichments and the introduction of 'Pietra-dura,' an inlay of highly polished marbles, agates, lapis-lazuli and other stones, came into vogue, as well as bas-reliefs of ivory and tortoise shell.

Designs became more and more elaborate, rectangular and architectural forms were discarded, and decorations assumed so profuse and exaggerated a character that the final period of decadence became inevitable.

While the unparalleled beauty of the Renaissance was making its way to France and penetrating into other countries further

Mahogany Pre-Chippendale Chair, English 18th Century

North, it had already begun to show its decline in Italy. Charles v., the ruler of a dominion of great area, was active in encouraging a uniform training for artists, so that pieces produced in different countries very closely resembled each other and could scarcely be distinguished from those constructed in Italy. Italian architects and painters were early summoned to France and with the reign of Francis I., the Renaissance was definitely established in France, giving fresh inspiration to architecture, furniture and all the decorative arts.



Heppelwhite Satinwood Arm Chair, English 18th Century

Spain came strongly under Italian Renaissance influence, but her decoration and use of Renaissance motifs were overly exaggerated. The chief characteristic of German furniture of this period, was 'an exuberant realism and a fondness for minute detail,' but in England the new impulse was slower to take root, and many national characteristics remained, keeping intact a certain native individuality. The change in the design of furniture naturally followed that of its architecture, and the Elizabethan Renaissance showed a freer use of ornament and was rich in carving, fluted columns, panels, and interlaced strap work. During this period of development, the chest evolved into a cabinet of many varieties; the simple *prie dieu* chair became an elaborate affair, and tables were now solid pieces of furniture instead of heavy boards and trussels as they were at the beginning of the Renaissance.

In England the 'court cupboard,' which became the forerunner of the future sideboard, made its appearance. It was made from native oak, the distinctive wood of the period. The continued growth of the English Renaissance in the seventeenth century, mingling with the ideals of Flemish workers in the Netherlands (which was then the art centre of northern Europe), developed the Jacobean style.

This type is often criticized as being heavy and awkward, but it was decidedly more restrained in form and ornament than the elaborate Tudor. Indeed, the furniture made in England after the middle of the seventeenth century is most delightful, and

French Chair of Gilded Wood, Grospoint Covering, Louis XV Period

though it still retained a certain massive quality, its stately form became more pliant through rich upholstery, and more beautiful by interesting carving and spiral turnings.

The refectory table, showing four or six legs, at first increasingly bulbous, but later becoming more refined in design, and the gateleg table of oak, with turned or spiral legs, were developments of this time. The first couch with adjustable head-rest and elaborately carved legs and stretches also belongs to this period, and is the first premonition of the later day-bed or chaise-longue.

Walnut was used for the first time in the later examples of Jacobean furniture. The William and Mary and Queen Anne styles that followed largely reflected Dutch and some French influences. They were usually fashioned from walnut, except when marquetry work was introduced, and then various woods were employed, combined in a way to form modest, pleasing designs on a ground work of walnut. This type of work emanated from, though it was not invented by, the great French ébenéste, André Charles Boulle (q.v.), who was responsible for some of the most sumptuous and remarkable examples of furniture that marked the resplendent reign of Louis XIV. 'Boulle work,' to which his name was given, consisted of inserting as inlays, various contrasting woods, brass, and tortoise shell into plain surfaces forming the most intricate designs. This delight in gay decorations, lighter forms and more elegant French interiors and furnishings, began in the reign of Francis I., and by the end of Louis XIII.'s régime (1600 to 1643), Italian influence had waned, and France had created and was expressing a native taste of her own. This developed into three very distinct styles to which the three monarchs have given the names of 'Louis Quatorze,' 'Louis Quinze,' and 'Louis Sieze,' each style merging into that of its successor. The majestic grandeur of those royal pieces created in the time of Louis Quatorze, later verged upon the effeminate in the desire for freer curves, ever greater adornment and embellishment, until their over-elaboration culminated in the rococo style of Louis Quinze.

Satiated with the extravagance and frivolity of the latter reign, which was reflected in the highly fanciful and ornate furnishings of the time, Marie Antoinette and her Court sought a simpler life, and immediately furniture and furnishings adapted themselves to the 'appartement privé,' which intentionally differed in every respect from the rooms of State, and imposing chambers of Louis XIV., and the light, artificial atmosphere of the salons and boudoirs of Louis XV. This revulsion, combined with the revival of classic taste through the discoveries of ancient treasures in Herculaneum and Pompeii, produced the dominant style under Louis XVI., in which symmetry of form, restraint in ornament and the most chaste beauty of detail, is perhaps more delightful and perfect in achievement than anything that has ever been done in furniture.

Indeed, the eighteenth century stands out as the pre-eminent era of the cabinet maker.

The greatest feats in craftsmanship were achieved by such men as David Röntgen, Gouthière, Riesener, Oeben, Rousseau de la Rottière, Jacob, and others. The marquetry of this period was executed with the finest skill; mountings in gilt bronze, peculiarly characteristic of this epoch, were more delicate and subtle in conception and showed more certainty in execution than ever before or since. The earlier periods from Francis I. through Louis XIV. and the Regency, were often marked by grandeur and eloquence, but that of Louis XVI. before the great upheaval in social and political life, reached the acme in the annals of furniture.

It was not to be expected that such perfection of achievement could endure. After the unhappy ending of Louis XVI. and Marie Antoinette, the Directoire style, still fostering Classic design, was shortly followed by the so-called Empire period under Napoleon I. Though lacking in inspiration and grace, this development is interesting, because it, too, was an interpretation of the Classic (reaching back to Greece, Rome and even Egypt, for its form and decoration) and

Eighteenth Century Italian Bed of Carved and Gilt Wood, Upholstered in Brocatelle

Furniture

in its heavy masculinity it reflected the entirely new spirit, later to end in disaster, that animated France. At its best, it possesses a certain imperial dignity. Articles were fashioned from mahogany and rosewood

American 17th Century Arm Chair of Maple and Hickory

with no carving, but their large plain surfaces of beautifully grained wood had rather heavy motifs of ormolu or bronze. This style was the antithesis of the chaste, delicately painted or inlaid pieces created in the time of Louis XVI., lacking not only their graceful conception, but their extraordinary execution as well. The influence, exercised by the splendor of the court of the Louis' impressed itself upon the contemporary rulers of other countries, and Germany, Holland and England were especially affected.

The eighteenth century brought forth a brilliant school of cabinet makers in England—the names of Adam, Chippendale, Sheraton, Hepplewhite, and Shearer, all master craftsmen and designers, became renowned, making the latter part of the century one of the most important epochs in English furniture making. The use of mahogany began about the year 1720, displacing walnut, whose beauty of grain made it sufficiently decorative in itself. Mahogany lent itself admirably to carving, a quality which inspired a new and more elaborate ornamentation. Satinwood and softwood (which was painted, gilded or japanned) were also used, as well as a choice of figured woods for veneer and inlay.

English designers were largely influenced by contemporaneous French fashions, though they retained a feeling for the old Gothic and Chinese as well. The brothers Adam were architects and designed all the objects for the interiors they planned. They were followers of the Classic which they studied in Italy and France, absorbing those models which were adaptable to their purpose. They employed satinwood, tulipwood, and mahogany, either alone or in combination, for the furniture whose designs, chaste and graceful, were reminiscent of the models of Louis XVI. Painting was their favorite form of decoration, and artists of renown were employed to embellish many of their important pieces.

Chippendale carried out some of Adam's designs, but also introduced ideas of his own. He continued the development of the cabriole leg, with or without ball and clawfeet, and evolved characteristic forms of decoration by which his designs can easily be distinguished. His importance lay not only in the production of individual pieces of great merit and beauty, but also because of his influence upon the taste of the day, both in England and America. The two other notable personalities of this period were Sheraton and Heppelwhite, whose contributions in both the design and execution of furniture making have not been equalled since.

It is of comparatively recent date, that a more general appreciation of early American furniture has been aroused. Though it followed and adapted contemporaneous English, Dutch and French models, the articles were executed in a different manner, and those that can be classed as 'Americana' were fashioned from native woods, and have a characteristically artistic feeling all their own. The term 'Colonial' has been erroneously and promiscuously applied to American pieces, even including Empire, whereas nothing is Colonial that follows 1776, and strictly speaking, the term should not be applied to furniture that came later than Chippendale. The very early pieces are Tudor and Jacobean in type, some having been brought from England by the early comers who first settled in Virginia in 1607. They include chests, buffets, court cupboards, chairs, tables, and stools, from which American pieces were copied. English chests, which held valuable goods and were the most cherished articles of furniture, were imported in greater numbers than any other furniture and were America's most direct source of design.

The middle of the seventeenth

American Sofa of Walnut Upholstered in Velvet, 18th Century

At the close of the century, England coming under the influence of the decadent spirit exemplified in the French Empire, developed what is known as the English Empire, and thus the century ushered in other types—Cromwellian and Spanish examples among others, and in the Northern States during the latter half of the seventeenth century, the manufacture of English and

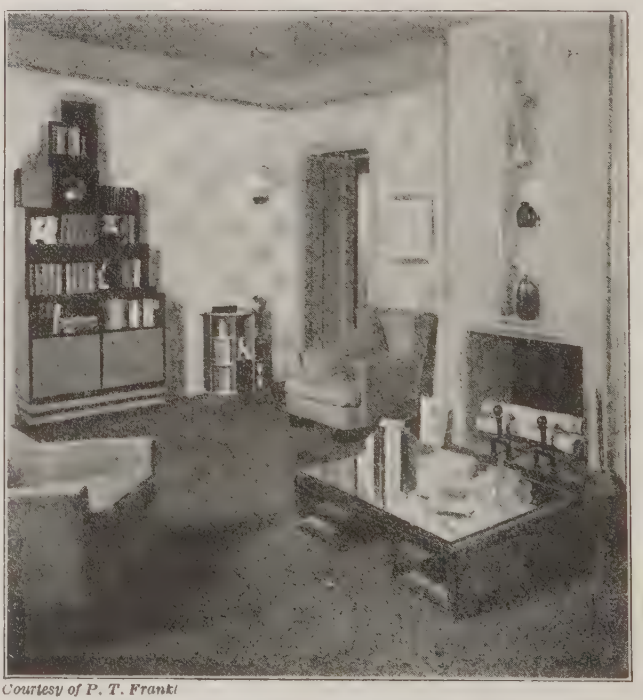
Furniture

Hickory Windsor Arm Chairs, American Eighteenth Century

Dutch types became more characteristically American. The pieces fashioned in the North were simpler than their prototypes or those made in the richer and more prosperous Southern States. Flemish chairs with elaborate scrolls and caned seats and backs became popular at this time.

As the eighteenth century advanced, and Chippendale and his fellow-workers became the leading craftsmen and designers in England, pieces following their design were exported to America, and mahogany, the wood then in vogue in England, largely took the place of the native American woods—walnut, oak, beech, sycamore, maple, pine and cherry that had been used until then. Some of the American productions followed the imported pieces so closely, that it is difficult to identify them except when pine or some other native wood is introduced as a part of their construction. Many fine examples of furniture were made in Philadelphia from about 1725 to the end of the Revolution, when the names Savery, Randolph and Gilling became celebrated. Beautiful specimens also came from Alexandria, Virginia; from Baltimore, Boston, Annapolis, and Newport, Rhode Island, the latter place boasting of the production of fine desks and chests by one John Goddard.

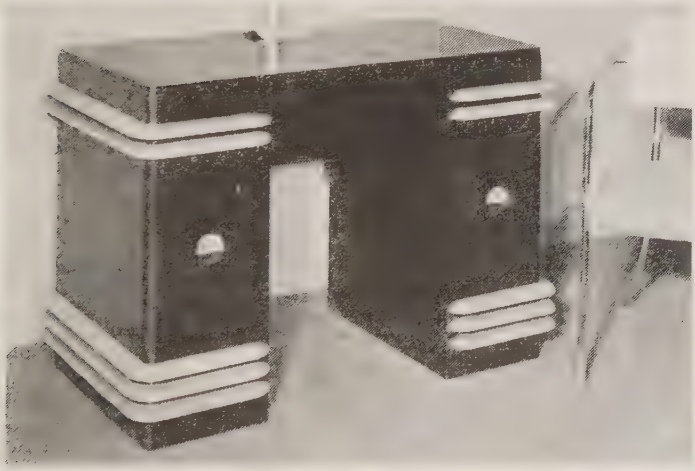
At the end of the eighteenth century, the American Empire, following the French type of that name came into vogue, after which there was a reversion to the *ancien régime*, and the period of Louis Quinze claimed attention with its elaborate scrolls and curves. This captious revival, however, entirely lacked the character, lightness, skilful execution, and charm of the early eighteenth century pieces. Indeed, in England, ornament of this type lost all restraint, forms became heavy and ponderous, and the furniture and furnishings of this period, which is known as the Victorian Age, degenerated into an era of extraordinary ugliness and poor taste. Machines were used for the purpose of economizing labor and expense, and workmanship became clumsy and mechanical, entirely uncontrolled 'by the sensitive touch of the hu-



Courtesy of P. T. Frankl

Modernistic Bookcase and Table

A MODERN FURNITURE SETTING EXPRESSED IN TUBULAR CHROME STEEL. SOFT, PASTEL-COLORED UPHOLSTERY ADDS WARMTH TO THE SLEEK, CHROME FRAMES. FORMICA TOPS ON CARD AND END TABLES ARE IMPERVIOUS TO HEAT AND LIQUIDS



A STREAMLINED ZEPHYR DESK FINISHED IN EBONY AND SILVER. IT HAS EIGHT DRAWERS, ONE OF DOUBLE DEPTH, FOR FILING PAPERS

A GROUPING OF MODERN NURSERY FURNITURE IN BLOND MAPLE. THE BLEACHED WOODS APPEAL TO CHILDREN AND THE DESIGNS ARE EDUCATIONAL AS WELL AS DECORATIVE

Photos courtesy of American Furniture Mart, Chicago

man hand.' America, too, passed through the 'Victorian Age,' the most menacing to art in all history. Fortunately, a desire for beauty was reawakened, and since no striking creative impulse manifested itself, a passion for antiques of all periods that lent themselves to modern living was again revived. Originals were eagerly sought and copied, until the supply of beautiful, old examples ran low.

The Modernistic Movement is now receiving recognition by a certain number of people who repudiate for the time being at least, 'period furniture.' This modernistic style of decoration shows a fresh spirit of its own. It originated in Austria and Germany, took flame in France, and has now spread to America. Departing entirely from curves, which a short time ago were the ideal in decorative beauty, it affects the square and angular, seeking perpendicular heights like the sky scraper, or, going to the other extreme, shows a penchant for furniture that lies prone upon the ground or that stands upon supports only one or two feet high. It is designed on straight lines which can be accomplished more easily with the modern tool —the machine, and its surfaces are skilfully finished, revealing when possible, the wood's beauty of grain and natural coloring. It depends for its effect upon form, eliminating all carving and other decorative elements. Cubist and post-impressionist designs take the place of classic motifs, and wood and metal vie with each other for supremacy in its construction.

Museums, private collections, and loan exhibitions that can be found in all countries to-day, offer the best means of studying furniture and its evolution, for it is by repeatedly seeing different types that one learns to recognize and appreciate their various characteristics, and the periods to which they belong. Many authoritative books have been written which give full, rich and detailed accounts of furniture and its history. Among a long list the following may be cited: Burgess' *Antique Furniture;* Singleton's *Furniture and the Furniture of Our Forefathers;* Dyer's *Handbook of Furniture Styles* (1918); Binstead's *Furniture* (1919); Sanders' *How to Know Good Furniture* (1924); Clason's *The Story of Period Furniture* (1925); Gayler's *Furniture, Yesterday and Today* (1926); Richter's *Ancient Furniture* (1926); Scmitz' *The Encyclopedia of Furniture* (1926).

Fur'nivall, FREDERICK JAMES (1825–1910), English philologist, was born in Egham, Surrey. He was called to the bar in 1849 and later helped to establish the London Workingmen's College. Appointed in 1854 honorary secretary of the Philological Society, he largely influenced the compilation of the *New English* (or *Oxford*) *Dictionary*, which began to appear in 1884. In 1864 he established the Early English Text Society; in 1868 the Chaucer and Ballad Societies; in 1874 the New Shakespeare Society; in 1881 (with Miss Hickey) the Browning Society; in 1882 the Wycliffe Society; and in 1886 the Shelley Society. For these and the Roxburgh Club he edited indefatigably. Among his numerous publications may be mentioned *Saint Graal*, in English verse, by Henry Lonelich, A.D. 1440 (2 vols., 1861–3); Robert of Brunne's *Handlyng Synne* (1862); Walter Map's *Quest del Saint Graal* (1864); *Political, Religious, and Love Poems* (1866);—*Bishop Percy's Folio MS. of Ballads and Romances* (2 vols., 1867–8); *Six-Text Print of Chaucer's Canterbury Tales* (1868–77); 'The Succession of Shakespeare's Works,' introduction to Gervinus' *Commentaries* (1874); minute and elaborate introduction to the *Leopold Shakespeare* (1877); *Originals and Analogues of Some of the Canterbury Tales*, with Brock and Clouston (1888); *Caxton's Eneydos*, with W. T. Culley (1890); *Hoccleve's Works* (part i., 1892; part iii., 1897); *The English Conquest of Ireland, A.D. 1165–85*, from Giraldus Cambrensis (1896). With John Munro he wrote introductions to the 39 volumes of the *Century Shakespeare* and of *Shakespeare's Life and Work* (1908). Consult *Frederick James Furnivall: a Volume of Personal Record* (1911).

Furnival's Inn, a non-corporate legal society of London, England, which was affiliated to Lincoln's Inn. The Inn was rebuilt in 1817, when it ceased to exist as a legal community, and is now demolished. See INNS OF COURT.

Furruckabad. See FARRUKHABAD.

Furs. See FUR.

Fursch-Madi, fürsh' mà-dē', EMMA (1847–94), French soprano singer, was born in Bayonne, and studied in Paris. She successfully sang the leading soprano parts in *Aïda, Don Giovanni, Huguenots, Trovatore*, and other operas of a dramatic character in France and England, and in 1884 went to the United States under the management of Mapleson. After retiring from the stage (1894) she taught singing at the New York College of Music.

Fur Seal. See SEALS.

Fürst. See PRINCE.

Fürst, JULIUS (1805–73), German Orientalist, was born in Zerkowo, of Jewish descent. He was educated for a rabbi but becoming weaned from the Jewish faith he occupied himself with Oriental and antiquarian study and in 1833 settled at Leipzig, where he became professor of Aramaic and Talmudic literature (1864). He published numerous works on Oriental languages and literature, including *Concordantiæ Veteris Testamenti Hebraicæ et Chaldaicæ* (1837–40; Eng. trans.); *Die Spruche der Vater* (1839); *Bibliotheca Judaica* (1849–63); *Geschichte der Biblischen Literatur und des Jüdisch-Hellenistischen Schriftthums* (1867–70).

Fürst, WALTHER, Swiss hero, who represented the canton of Uri in the compact of liberation made in 1307, when Werner Stauffacher represented Schwyz, and Arnold Melchthal Unterwalden.

Fürstenberg, für'sten-berk, town, Prussia, in Brandenburg; 60 miles southeast of Berlin. Pop. 6,100.

Fürstenbund, für'sten-boont, THE, or LEAGUE OF PRINCES, a league of German princes formed by Frederick the Great on July 23, 1785, whose object was to check the attempt of the Emperor Joseph II. to secure Bavaria. It embraced Prussia, Saxony, Hanover, and numerous smaller German states.

Fürstenwalde, für'sten-välde, town, Prussia, in the province of Brandenburg, on the River Spree; 21 miles by rail west of Frankfort-on-the-Oder. It has breweries, malt kilns, and manufactures of glass, starch, electric and gas fittings, and stoves. Pop. 21,522.

Fürth, fürt, or FUERTH, city, Bavaria, in the province of Middle Franconia, situated at the junction of the Rednitz and Pegnitz Rivers; 5 miles northwest of Nuremberg, with which it forms an important manufacturing centre. It has a theatre, Rathaus, agricultural school, school for wood workers, and gymnasium. There are four evangelical churches, the most noteworthy of which is St. Michael's, built in the fourteenth century, and a fine synagogue. Manufactures include mirrors, gold leaf, bronzes, toys, pencils, optical instruments, spectacles, shoes, leather goods, furniture, cabinetwork, machinery, Venetian blinds, and beer. It is also a centre for lithographic work.

The city is said to have been founded by Charlemagne. In 1632 it was unsuccessfully besieged by Gustavus Adolphus, and in 1634 it was burned by the Croatians. The city passed from Prussia to Bavaria in 1806. Pop. (1925) 73,693.

Fürth, town, Bavaria, on the borders of Bohemia; 40 miles northeast of Ratisbon. It manu-

factures toys, and has glass industries. Pop. 6,029.

Further India. See INDO-CHINA.

Fur Trade. See FUR.

Fur Tribe, a negro people who inhabit the central highlands of Darfur (q. v.), in Eastern Sudan. They are tall and very black, with woolly hair and projecting jaws. They are chiefly agricultural and pastoral, and raise large herds of cattle, camels, horses, and sheep. Their language is related to Nuba. The Furs are one of the races formerly dominant in the Egyptian Sudan. They were ruled by native kings from 1444 to 1874, when they were conquered by the slave dealer Zebehr Pasha. Since 1899 they have been under Anglo-Egyptian dominion. They embraced Mohammedanism in the fifteenth century.

Furunculosis. See BOIL.

Fury and Hec'la Strait, Canada, in 70° N. lat., separates Melville Peninsula from Cockburn Island, and connects Fox Channel with the Gulf of Boothia. It was discovered by Parry in 1822, and named after his ships.

Furze, fûrz (*Ulex*), a European genus of very branched and thorny shrubs, with linear, sharply pointed leaves, solitary flowers, and two-lipped calyx, belonging to the order Leguminosæ. The common furze (*U. europæus*), also called *whin* and *gorse*, is found in the southern parts of Europe and in Great Britain. Furze is sometimes planted for hedges, but occupies great breadth of ground without readily acquiring sufficient strength; nor is it thickened by cutting. It affords a wholesome fodder, especially when young, or when its thorns are artificially bruised; and in certain districts is still of great value as fuel.

Fusagasugá, fōō-sä'gä-sōō-gä', town, Cundinamarca, Colombia; 25 miles southwest of Bogotá. It is a centre of coffee planting, and a country resort of Bogotá. Altitude, 5,810 feet. Pop. 8,000.

Fusan, fōō-sän', FU-SAN, or PUSAN, treaty port and capital of Korea, is situated on Korea Bay, 7 miles from the mouth of the Nak-tong River, at the terminus of the Seoul-Fusan Railroad; 286 miles southeast of Seoul. There are steamship lines to Nagasaki, Shanghai, Chefoo, Port Arthur, and Vladivostok. Fusan comprises the old Korean city and the new Japanese town, which is the administrative headquarters for the province. Since the formal annexation of Korea to Japan in 1910, extensive improvements have been made in lighting facilities, water works, and roads. Harbor improvements are also in progress. The principal exports are rice, beans, hides, whale meat, and dried fish; the chief imports are petroleum and cotton. In 1914 the total trade was valued at about $15,500,000. Herring and cod fisheries are important. Fusan was opened to foreign trade in 1876. Pop. 50,565, of whom 26,586 were Japanese.

Fusaro, Lake of, fōō-zä'rō, also called the ACHERUSIAN LAKE, a small lake of Italy, 6 miles west of Naples, famous for its oysters.

Fuscaldo, fōōs-käl'dō, commune, province Cosenza, Italy, on the western coast of Calabria; 15 miles northwest of Cosenza. Pop. 10,000.

Fusee, fū-zē'. **(1.)** A match with a large oval head of a mixture of charcoal, saltpetre, cascarilla, glass, and gum, tipped with some common igniting composition. The fusee flames when struck, but thereafter forms a glowing mass, and thus serves for ignition purposes in a high wind. See FUSES AND PRIMERS.

(2.) The *mechanical fusee*, formerly used in clocks and watches, is a spirally grooved cone connected by chain or catgut with the mainspring. See HOROLOGY.

Fuseli, fōō'ze-lē, HENRY, or JOHANN HEINRICH FUESSLI (1741–1825), Anglo-Swiss painter and author, was born in Zürich. After a visit to England he proceeded to Italy in 1770, where he remained for eight years, studying in particular the works of Michelangelo. After his return to England he was elected in 1790 a member of the Royal Academy, where, nine years later, he became professor of painting. His paintings, some 200 in number, include *The Nightmare* (1781), and two series to illustrate Shakespeare's and Milton's works. His *Lectures on Painters* contain some of the best art criticism in the English language.

Fusel Oil, fū'zel (FOUSEL OIL), known also as POTATO SPIRIT, a colorless, oily fluid with a disagreeable odor and burning taste. It is a frequent impurity in spirits distilled from fermented potatoes, barley, rye, etc. Being less volatile than either alcohol or water, it accumulates in the last portions of the distilled liquor, and is much stronger in its intoxicating effects than ordinary alcohol. Its specific gravity is 0.811 at 19° C. (42° F.), and it boils at 132° C. (244° F.). The chief constituents are amyl, hexyl, propyl, isobutyl, methyl, and ethyl alcohols, the amyl alcohols predominating. It contains also some formic, acetic, propionic, butyric, valerianic, caproic, œnanthylic, caprylic, pelargonic, and capric acids, either in a free state or in combination.

Fusel oil is separated from ordinary alcohol largely by distillation, or by filtration through beds composed of layers of wood, charcoal, sand, broken oyster shells, and boiled wheat, or by a combination of these processes. It is utilized chiefly in the preparation of amyl acetate for solvent and flavoring purposes, in patent varnishes, and as a solvent for barks.

Fuses (FUZES) **and Primers.** *Fuse* is the name given to a variety of devices for firing explosives contained in military shells or mines, or used in blasting operations. The earliest were time fuses, consisting of a copper or iron tube filled with a slow-burning composition which was lighted from the flame of the powder charge. No regulation of the time of burning was possible until wood was substituted for metal in the outer casing. The first successful percussion fuse was invented shortly after the discovery of fulminate of mercury in 1799. Modern fuses are of three general classes: Percussion, Time, and Combination.

The *percussion fuse* consists of a cylindrical brass case, threaded to screw into the projectile. Inside the case is a priming charge of black powder, a percussion cap, and a plunger holding a firing pin. During flight, the motion of the projectile holds the plunger away from the cap; but when the projectile strikes, and its motion is checked suddenly, the plunger continues to move forward. The firing pin explodes the cap, the flame from which ignites the priming charge, which in turn ignites the bursting charge of the shell directly if of black powder, or through a detonating fuse if of high explosive. The *delay percussion fuse* explodes the cap upon impact, but the flame is delayed a fraction of a second in reaching the priming charge. This type is utilized for armor-piercing shot designed to perforate heavy side armor and burst inside a ship. Most percussion fuses are base fuses.

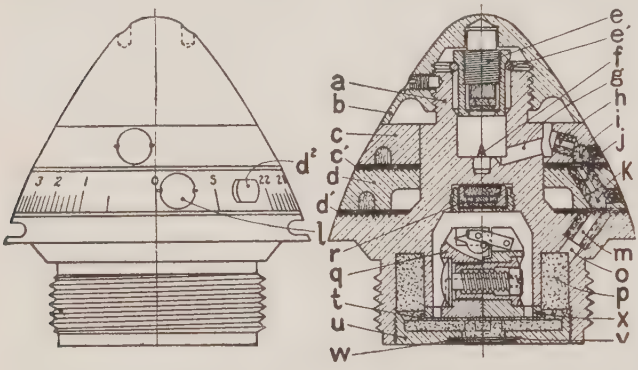
The *time fuse* contains the same elements as the percussion fuse, and in addition either a time train of compressed meal black powder, or a clockwork mechanism. The discharge of the gun causes the explosion of the cap, and this ignites the time train. The latter has a known rate of burning, and is graduated in seconds accordingly. The fuse can be set to burn any part of the whole train corresponding to the time of flight in seconds for the range to the target. The time fuse is now used only to help form the combination fuse.

The *combination fuse* consists of a time and a percussion fuse assembled in one body. It is a point fuse, and is used principally in shrapnel. The time element is set going by the concussion of discharge, while the percussion

element acts only when the shell strikes if the time element has not acted before impact.

The *mechanical fuse* was first developed by the Krupps, and contains a clockwork mechanism instead of the time train of black powder. The mechanism, which is set to run for the time of flight, is started by the shock of discharge, and explodes the percussion cap at the expiration of the time set.

When the bursting charge of a shell is a high explosive, the black powder fuse is not sufficient to secure explosion, and a *detonating fuse*, containing some violent and sensitive detonating composition,



Combination Fuse Used in U. S. Army.

a, Body; *d*, time train ring; *e*, concussion plunger; *f*, firing pin; *g*, vent to upper time train; *h*, compressed powder pellet; *o*, vent to magazine; *p*, powder magazine; *q*, percussion plunger; *r*, percussion primer.

is introduced between the bursting charge and the percussion fuse.

In blasting and mining operations the fuse generally employed is an electric detonating fuse, containing electric elements similar to those of the electric primer, and in addition a detonating composition. The compressed black powder safety fuse sometimes is used; but if blasting with high explosive, a detonator must be attached to the safety fuse.

The *primer* is a device employed to ignite the powder charge in guns. It consists of a brass tube filled with black powder, and containing devices for igniting the black powder and for preventing the escape of powder gas through the vent. Primers are classified, as to the method by which ignition is produced, into Electric, Friction, and Percussion. A combination primer may be fired by any two of these methods.

The *electric primer* is fired by passing an electric current through the firing circuit, which heats a small platinum wire and fires some dry guncotton wound around the platinum wire. It is most commonly used in large calibre cannon.

The *friction primer* is ignited by drawing a serrated wire through a friction composition. It is used in cannon of all calibres, and especially in combination with the electric primer.

The *percussion primer* is fired through a percussion cap, which is struck by a firing pin. It is generally used in cannon firing fixed ammunition, such as rapid-fire guns and the modern guns of the field artillery service.

See AMMUNITION; EXPLOSIVES. Consult publications of the Ordnance Departments, U. S. Army and U. S. Navy; *Journal U. S. Artillery;* Weaver's *Notes on Explosives* (1912); Marshall's *Explosives—Their Manufacture, Properties, Tests, and History* (1915).

Fushiki, fo͞o'shē-kē, or FUSHIGI, seaport on Toyama Bay, on the west coast of Hondo, Japan; 32 miles northeast of Kanazawa. It has been an open port since 1889. Pop. 20,000.

Fushimi, fo͞o'shē-mē, town, Hondo, Japan; 4 miles by rail southeast of Kioto. It was the scene, in January, 1868, of a severe struggle between the followers of the Shogun and the imperialists. Pop. 22,000.

Fu'sible Metal, any alloy which melts at a temperature below that of boiling water, and below the arithmetic mean of the temperatures of fusion of the component parts—a feature especially marked with certain alloys of bismuth. Such alloys expand on cooling, and thus take fine impressions of moulds. They are employed in electrotyping, in taking casts of medals and of wood cuts, in testing the finish of dies, for making anatomical casts and safety plugs for steam boilers, and in the construction of automatic fire sprinklers.

Examples are: *Rose's alloy*, composed of bismuth 2 parts, lead 1, tin 1; melts at 94° C. (201° F.). *Wood's alloy*, composed of bismuth 15 parts, tin 4, cadmium 3; melts at 60° C. (140° F.). *Lipowitz' alloy*, composed of bismuth 15 parts, lead 8, tin 4, cadmium 3; melts at 65° C. (151° F.). *D'Arcet's alloy*, composed of bismuth 8 parts, lead 8, tin 3; melts at 79° C. (174° F.). *Newton's alloy*, composed of bismuth 8 parts, lead 5, tin 3; melts at 94.5° C. (202° F.).

Fusiliers, fū-zil-ērz', were formerly British foot soldiers armed with a lighter fusil or musket than the rest of the army; but all regiments now carry the same pattern of rifle. Fusilier is therefore simply an historical title borne by a few regiments of the British army—viz., the Northumberland, Royal, Lancashire, Royal Scots, Royal Welsh, Royal Inniskilling, Royal Irish, Royal Munster, Royal Dublin, besides regiments in the native army of British India.

Fusion. The fusion or melting of a solid substance means its change of aggregation from the solid to a liquid condition. Solidification or freezing is the exact converse of fusion, and the attending phenomena are essentially similar in each case. The term *liquefaction* is usually restricted to the condensation of a gas or vapor.

Fusion may be either crystalline or amorphous. In crystalline fusion, as in the case of ice, the change from solid to liquid occurs at a definite surface without any intermediate stage or plastic condition, and also at a definite temperature called the fusing or freezing point. To effect this change a certain quantity of heat, known as the latent heat of fusion, must be added to the solid, and a change of volume usually accompanies the fusion. Amorphous solidification, as in the case of alcohol and many organic liquids, takes place gradually without any definite freezing point or latent heat, and there is no sudden change of volume at any temperature. Substances that are liquid under ordinary conditions are said to have *freezing points*, while those that are ordinarily solid have *melting points*. The melting point of ice is chosen as one of the convenient temperatures in the construction of a temperature scale (see THERMOMETER).

When water has some impurity, such as salt, dissolved in it, no crystallization occurs until the temperature falls below the normal freezing point of water, the lowering of the freezing point being nearly proportional to the concentration of the solution. When freezing does begin, the solvent generally separates out

from the solution in the pure state. The remaining solution consequently increases in strength, and the temperature continues to fall as more of the solvent is separated. At a certain point the solution is saturated with respect to both salt and ice. The concentration cannot change further, the temperature remains constant, and the salt and ice crystallize out together. The resulting solid is termed a *cryohydrate*.

Substances, like ice, that increase in volume on freezing have their freezing points lowered by increase of pressure; while substances, like wax, that expand on fusing, have their melting points raised by pressure, the effect of pressure being to retard increase of volume. Thus skating is possible because of the lowering of the freezing point under pressure, the ice melting momentarily under the narrow edge of the skate. A liquid may, in many cases, be cooled several degrees below its normal freezing point without solidifying, especially if it be protected from agitation. When in this state a liquid is said to be 'undercooled,' 'metastable,' or 'superfused.'

Crystalline fusion is said to be homogeneous when the composition of the solid and liquid phases is the same, and the temperature remains constant. This is the case with pure substances. In the case of an alloy or a solution the fusion is heterogeneous; the solid and liquid phases differ in composition, and the temperature does not remain constant during the fusion. The fact that the fusing or freezing point of a pure substance is constant affords a convenient test of its purity. See FREEZING; MELTING.

Fusi-yama. See FUJI-SAN.

Fust, fōōst, or FAUST, JOHANN (d. 1466), German printer, a native of Mainz, who entered into partnership with Johann Gutenberg (q. v.) in 1450, for which he supplied the funds and Gutenberg the printing apparatus. In 1455 Fust claimed the restoration of his capital; Gutenberg was unable to pay; and Fust took possession of some of the presses and established a separate printing house with his son-in-law, Peter Schöffer. During the partnership with Gutenberg, *The Bible of 42 Lines* (1450–55), known also as the Gutenberg or Mazarin Bible, was produced. A folio edition of the *Psalter* (1457) was one of the most important works issued with Schöffer. See PRINTING.

Fustel de Coulanges, füs-tel' de kōō-läńzh', NUMA DENIS (1830–89), French historian, was born in Paris. In 1860 he was appointed professor of history at Strassburg. His first historical work, *La Cité Antique* (1864; Eng. trans.), which threw a flood of fresh light on the social and religious institutions of antiquity, made its author famous, and ultimately caused his appointment to a specially created chair at the Sorbonne. He was also instructor to the Empress Eugénie. After the war of 1870 he turned to French history. His principal production, *Histoire des Institutions Politiques de l'Ancienne France*, was completed and published in six volumes in 1892. His essays appeared as *Recherches sur Quelques Problèmes d'Histoire* (1885), *Nouvelles Recherches* (1891) and *Questions Historiques* (1893). Consult P. Guiraud's *Life*, in French.

Fustian, fus'chan, is a name given to certain kinds of heavy cotton fabrics, including moleskin, velveret, velveteen, beaverteen, corduroy, and other varieties. They are chiefly used for men's apparel, and are nearly all of the nature of velvet. See CORDUROY; VELVET.

Fus'tic, a name given to two distinct dyewoods, employed either for producing a yellow color, or for supplying the yellow portion of compound colors, as greens and browns. *Old fustic* consists of the wood of *Chlorophora tinctoria*, a large tree of the order *Moraceæ*, native to Brazil, Mexico, and the West Indies. It contains a yellow coloring matter known as *moritannic acid*, and produces more permanent colors than young fustic. It was formerly much used for dyeing woollens, but it has been largely replaced by coal-tar products and the bichromates of potash and lead. The wood is also used for inlaying. *Young fustic*, or Venetian Sumach, is derived from the Smoke Tree (*Rhus cotinus*), a shrub of Southern Europe, and contains a coloring principle known as *fustin* or *fusleric*. It is used principally in combination with other dyes.

Fusulina, fū'sū-lī'nà, a spindle-shaped, calcareous shell, sometimes half an inch in diameter, belonging to a genus of the group Foraminifera (q. v.). In shape it somewhat resembles a grain of wheat, and when broken open it is seen to consist of many small chambers, which in the living condition are filled with protoplasm. It is one of the most complex and highly organized animals of its group, and bears a considerable resemblance to the better known nummulites (q. v.). These shells are especially abundant in the Carboniferous period. Fusulina limestones are largely developed in Japan, China, Russia, Sumatra, and North America.

Fu'sus, a genus of gasteropods, which are allied to the British whelk (q. v.) and American conch (q. v.), and which include, in *F. colosseus*, perhaps the largest living gasteropod. The shell is fusiform, with a many-whorled spire and a long, straight canal. One species, *F. antiquus*, is dredged in the seas about Great Britain to be sold in the London markets as food.

Futa Jallon, fü-tä'zhà-lôń', a mountainous region in the interior of French Guinea, West Africa, covering an area of about 42,500 square miles, and having an altitude of from 4,000 to 5,000

Fusus.

feet. The climate is favorable, and the territory is rich in forests and gold. Cattle are raised extensively, and coffee, maize, rice, and cotton are produced. The Senegal, Gambia, and Niger Rivers have their sources in the highlands. Futa Jallon is a protectorate of the French government, and is divided into four administrative circles, under French officials; but the native government is in the hands of native princes (*almamys*) and an assembly of nobles. Timbo is the capital; Tuba and Labe are important towns. The original inhabitants were conquered by the Fulahs (q. v.) in the sixteenth century. A treaty of peace with France was signed in 1881, and the French protectorate was established in 1893. Pop. 600,000, mostly Fulahs.

Futa-Toro, fü-tä'-tō-rō', or FOOTA-TORO, a fertile and level territory in the northern part of French Senegal, West Africa. It has tamarind forests, and exports pig iron. Pop. 120,000.

Futch'el, a piece of wood placed lengthwise on a carriage frame to support the pole and splinter bar.

Futhorc. See RUNES.

Futtehpur. See FATEHPUR.

Fut'tock, nautical term applied to any of the curved timbers in the built-up frame of a wooden ship running outward from the floor or cross timber, and upward to the top timber.

Futtygurh. See FATEHGARH.

Future Estate, in law, one created by will or deed to take effect after an interval. This might seem as unobjectionable as an immediacy; but in fact, few transfers of property have been so jealously disfavored and restricted. First, even till the nineteenth century an 'estate' could be only of landed property, and only an estate could have divided or deferred interests; personal property or rights were allowed

but one control, and an 'executory' addition to a life use had no force, and left the user sole owner. This distinction is now abolished. Second (at bottom from feudal investiture being the only title to lands), till the Reformation even landed estates could have no futures created except as reversions (return to grantor or heirs) or remainders (taking effect on expiry of an intervening grant). The latter obviously had no being unless such grant was made, and therefore a mere gift of fee or interest after a date was void.

More modern business needs resented these barriers, and in 1535–40 two forms of blank futures were legalized, the 'springing' and 'shifting' uses—springing into being or shifting to other grantees on certain contingencies: as, to the use of a son if a daughter married, or to a cousin until a son returned from war or pilgrimage. If made by will, these were called 'executory' devises, as not directly self-executing, but needing later executors. English law has not gone beyond these forms; American law is divided, some States retaining them, others allowing any kind of future for any kind of property; the only restriction being that against perpetuities—that they must not take effect beyond lives in being and 21 years 9 months extra.

A necessary incident to the utility of futures is that they shall be alienable, heritable, and legally protected from malversation, like present property; and this, in turn, makes any unpermitted alienation by the intervening possessor invalid—contrary to a mere equitable interest, which may be fraudulently sold out without recourse against an innocent purchaser. This power of transfer puts certain other interests on the footing of future estates; as right of entry for breach of condition, mutual interest of husband and wife in their estates, wife's right of dower, etc.

See ESTATES; PERPETUITIES, RULE AGAINST.

Futures. See SPECULATION.

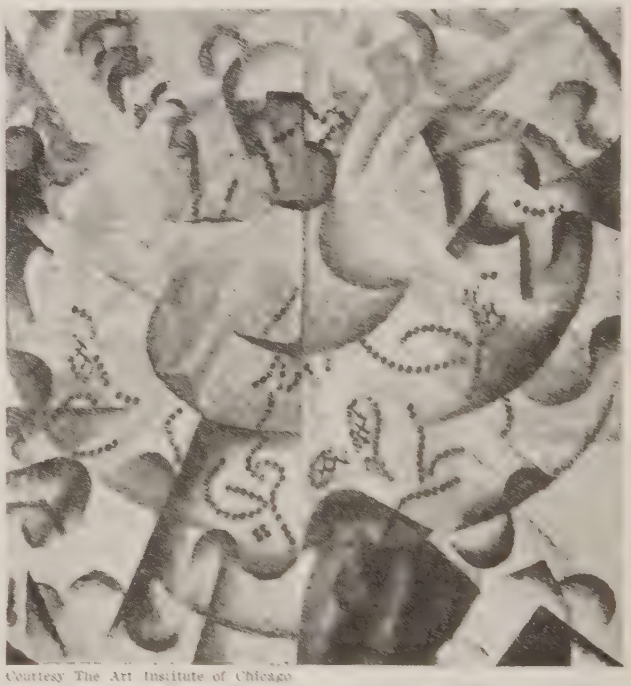
Future State. See ESCHATOLOGY.

Fu'turists, the name adopted by the exponents of a revolutionary movement in art and literature, inaugurated about 1907 by F. T. Marinetti, a journalist of Milan, Italy. In painting, futurism manifests itself in an attempt to translate the idea of motion into plastic art. In poetry, it seeks freedom of expression through escape from the laws of rhyme and grammar.

According to an early manifesto, the Futurists stand for the rejection of imitation and the glorification of the original; for rebellion against such elastic terms as 'harmony' and 'good taste'; for the rejection of subjects previously used, in order that they may express the beauty of speed, the dominating force of modern life; for complimentariness of subjects and colors as an absolute necessity in painting; and for the rendition in painting of 'universal dynamism as dynamic sensation.'

Fuz'zy-wuz'zies, sobriquet applied by British troops to a Hamitic tribe of African nomads inhabiting the Eastern Sudan from the Abyssinian frontier to Suakin. The name refers to the elaborate character of their hairdressing. Their proper designation is Hadendoa.

Fyffe, fif, CHARLES ALAN (1845–92), English historian was born at Blackheath, London. He was the author of *History of Modern Europe* (3 vols., 1880–90), which was widely read. During the Franco-German War he acted as correspondent to the *Daily News*



Courtesy The Art Institute of Chicago

DETAIL FROM A FUTURIST PAINTING, "THE DANCER," BY SEVERINI

Fylfot.

Fylfot, fil'fot, a pre-Christian form of cross, found on very ancient remains in Southern Europe. It has an immense range in both hemispheres and is the *svastika* or *svastika* of the Buddhists. See CROSS; SVASTIKA.

Fyne, fin, LOCH, an arm of the Firth of Clyde, Scotland; runs in a north and northeast direction from Bute Sound for 40 miles through Argyllshire. Its breadth varies from 1 to 5 miles. On its west side are East Tarbert Loch, with the fishing town of Tarbert; Loch Gilp, with Lochgilphead, and Ardrishaig at the southeast end of the Crinan Canal. Inveraray lies on the west shore, near the head of the loch. Loch Fyne herrings are famous for their size and flavor.

Fyrd, ferd, an Anglo-Saxon term for the military forces of the nation, which comprised all males capable of bearing arms.

Fyt, fit, JOHANNES (1611-61), Flemish animal painter and etcher, was born in Antwerp, and studied there, in France, and at Rome. He was unsurpassed in portraying dogs, the coats of animals, and the plumage of birds. Specimens of his work are: *Dog Devouring Game; Dead Game* (Louvre); *Two Greyhounds* (Antwerp); *Dead Game* (New York).

Fyvie, fi'vē, town, Aberdeenshire, Scotland, on the River Ythan; 23 miles northwest of Aberdeen. In the parish is Fyvie Castle, a royal residence in the thirteenth and fourteenth centuries. Pop. 2,786.

Fyzabad. See FAIZABAD.

G. The original sound of this letter is retained in such words as 'beg.' This is its value in scientific notation; it is a voiced k, or voiced back stop (see K). The sound in the modern English name, generally used before e, i, and y, is a compound = d + zh; it appears from the 14th century under old French influence. The simple sound zh occurs in some words (*e.g.* 'rouge') under modern French influence. G has also acquired these same values in Arabic.

Gh usually represented spirant k, when that was an English sound. It has now become silent, as in 'plough,' or changed into f, as in 'laugh.'

Since the invention of printing, y, and occasionally z, have been substituted for G, because of their resemblance to one of its written forms. From an early date this form resembles z; a variety of it is that still used in the modern Irish alphabet; g and *g* are modifications of it. In the 13th and 14th centuries, in English, this form stood for spirant g, also written gh. Where z and y represent G they have this spirant value (*e.g.* in 'Menzies'). See consonantal Y.

In form G is a modification of C (see ALPHABET), and that a rounding of —, and that a turning of the early Semitic form to the right. See SCALE.

Gá is the Old English form of the High German *gau*, which corresponds with a division of the country.

Gabacho, the Catalan designation of the natives of certain parts of the eastern Pyrenees; used also as a term of contempt for a Frenchman.

Gabb, WILLIAM MORE (1839–78), American palæontologist, was born in Philadelphia and educated there at the Academy of Sciences. From 1862 to 1865 he was connected with the geological survey of California under Josiah D. Whitney, in the classification of cretaceous and tertiary fossils. He was occupied in a survey of Santo Domingo and Costa Rica from 1869 to 1873, and in Costa Rica made extensive collections in ethnology and history for the Smithsonian Institution. His knowledge of invertebrates during the cretaceous and tertiary ages gave him almost unrivalled rank with scientists. Among his publications are *Geological Survey of California* (1864); on the geology and topography of Santo Domingo (1873); and on the ethnology of Costa Rica, in the *Transactions of the American Philosophical Society.*

Gabbro, a massive, dark-colored, crystalline rock, similar in structure and texture to granite, but corresponding in composition to the basalts. It is the plutonic representative of the basic igneous rocks, and has formed by slow cooling at great depths. The minerals of gabbro are basic plagioclase feldspar, augite (diallage), and often olivine. All gabbros contain also iron oxides and apatite, and some, in addition to these, quartz, orthoclase, garnet, hornblende or biotite. When diallage is replaced by hypersthene, the rock is known as norite, or olivine norite, according as it does or does not contain olivine. Anorthosite is a gabbro in which the plagioclase feldspar greatly preponderates over the other minerals. Gabbros cover enormous areas in Canada, and are found in the Lake Superior region and in the Adirondacks. All of the common varieties occur in Minnesota and New York. At Duluth gabbro is used somewhat as a building stone under the name 'Duluth granite.' In Sweden, Finland, and Norway many large outcrops of gabbro are known. They tend, as a rule, to be accompanied by serpentine.

Gabelentz, HANS CONON VON DER (1807–74), German philologist, born at Altenburg; filled various posts under the governments of Saxe-Weimar and Saxe-Altenburg. He is said to have learned eighty languages, in thirty of which he could converse with ease. He made a special study of the Finno-Tartaric languages, and in 1833 published *Eléments de la Grammaire Mandchoue*, which was followed in 1841 by *Grundzüge der Syrjänischen Grammatik* and *Die Melanesischen Sprachen* (1860–73). He contributed copiously to the *Zeitschrift für die Kunde des Morgenlandes*, of which he was joint-editor.—His son, HANS GEORG CONON VON DER GABELENTZ (1840–93), born at Poschwitz, near Altenburg, was professor of Eastern Asiatic languages at Leipzig (1878) and Berlin (1889), and wrote *Chinesiche Grammatik* (1881), *Beiträge zur Kenntnis der Melanesischen, Mikronesischen und Papuanischen Sprachen* (1882), *Confucius und seine Lehre* (1888), and other books.

Gabelle, an oppressive tax on salt in pre-revolutionary France. Every individual over the age of seven years, not being a member of the privileged classes, was forced to buy a certain quantity of salt at the price fixed by the government. See E. P. Beaulieu's *Les Gabelles sous Louis XIV.* (1903).

Gabelsberger, FRANZ XAVER- (1789–1849), inventor of the chief German system of shorthand, born at Munich; he became a member of the Bavarian civil service, chiefly in the ministry of the interior. His system is generally adopted in German-speaking countries, and is described in his *Anleitung zur Deutschen Redezeichenkunst oder Stenographie* (2d ed. 1850, reprinted 1900). He also published *Neue Vervollkommnungen in der Deutschen Redezeichenkunst* (2d ed. 1849). See *Gabelsberger's Leben und Streben* (2d ed. 1886), by Gerber.

Gaberlunzie, or GABERLUNZIEMAN, an old Scotch name for a strolling beggar or mendicant; also a king's bedesman, who was a licensed beggar. The class is well represented in Edie Ochiltree of Scott's *Antiquary.*

Gaberones, ry. stn. (alt. 3,328 ft.), British Bechuanaland, between Mafeking and Palapye.

Gabes. See CABES.

Gabinius, AULUS, tribune of the commons at ancient Rome in 67 B.C., when he carried a law conferring extraordinary power on Pompey for waging war against the pirates. He was consul in 58, and from 57 to 54 governor of Syria. On his return to Rome in 54 he was tried for extortion and condemned; he went into exile, but on the outbreak of the Civil War in 49 he was recalled by Cæsar, whose side he took. He died in 48 B.C.

Gabion, an open cylinder made of brushwood, canvas, wire-netting, or iron bands, for use in fortification. Filled with loose earth, gabions are placed on end,

Gabion.

in tiers, to form a wall, behind which earth can be piled at a steeper slope than it would naturally assume; and the whole becomes a rampart impervious to shell-fire. It is usually constructed on the spot where it is needed and of whatever materials are at hand.

Gable, that portion of the wall of a building which fills the triangular space formed by the junction of the roof-slopes. In early examples gables were merely finished with a plain coping. Later they were ornamented with crockets or battlements, or broken into steps called 'corbie steps,' and terminated in a cross or some other ornament. It was characteristic of mediæval domestic architecture that the houses generally turned their gable ends to the street.

Gablonz, tn., Bohemia, Austria, on the Neisse, 8 m. by rail S.E. of Reichenberg; produces glass buttons, pearls, and ornaments, also cottons, woollens and cardboard. Pop. 21,086.

Gaboon See GABUN.

Gaboriau, EMILE (1835–73), French author of detective stories, born at Saujon; became famous through his novel *L'Affaire Lerouge*, which appeared in *Le Pays* in 1866, and was followed by *Le Dossier* 113 (1867), *Le Crime d'Orcival* (1868), *Monsieur Lecoq* (1869), *Les Esclaves de Paris* (1869), *La Vie Infernale* (1870), *L'Argent des Autres* (1874), and *La Dégringolade* (1876).

Gabriel, the archangel who interprets the vision of Daniel (Dan. 8:15 *f.*), and announces to Mary God's design to make her the mother of the Saviour (Luke 1:26). Explicit references to Gabriel in Scripture are few (see Dan. 9:21; Luke 1:19); but in the book of Enoch (ch. 9) he appears as one of the four great archangels (seven in Tobit 12:15, etc.); while the Targums make frequent mention of him—*e.g.* as the destroyer of Sennacherib's army. In the book of Daniel and in Luke, Gabriel is the revealing angel, and it is possibly this Jewish tradition which forms the basis of the Mohammedan conception of him as the revealer of the Koran. See ARCHANGEL.

Gabriel's Insurrection, an abortive insurrection of slaves in the vicinity of Richmond, Va., in 1800, instigated and planned by a slave named Gabriel, owned by one Thomas Prosser. With him was associated another slave known as 'Jack Bowler.' An attack on Richmond was planned, but the plot was discovered, and Gov. Monroe ordered out the militia and seized the slave leaders, who were severely punished.

Gabun, or GABON, or GABOON, riv., French Congo, W. Africa; is really an estuary (10 m. wide) by which several rivers, the chief of which is the Komo or Como, enter the Atlantic. See FRENCH CONGO.

Gachard, LOUIS PROSPER (1800–85), Belgian historical writer, born at Paris. In 1831 he became keeper of the archives at Brussels, an office he retained all his life. Of these archives he published extracts in *Correspondance de Philippe II. sur les Affaires des Pays-Bas* (1848–59), *Correspondance de Guillaume le Taciturne* (1847–58), *Retraite et Mort de Charles-Quint* (1854–5), *Don Carlos et Philippe II.* (1863), *La Belgique sous Philippe V.* (1868), and *Histoire Politique et Diplomatique de Pierre-Paul Rubens* (1877).

Gad, the seventh son of Jacob, by Zilpah, the handmaid of Leah (Gen. 30:10 *f.*), and the ancestor of the Israelite tribe of the same name. The territory of the tribe, embracing part of the region of Gilead, lay to the east of the Jordan and the Dead Sea (*cf.* Num. 32:34–36). Reuben was long dependent on Gad, and at length was absorbed by it. The name is borne by a seer at David's court (1 Chron. 21:9), and also by an Aramaic and Phœnician deity (the god of fortune; *cf.* Delitzsch on Gen. 30:11). See GILEAD.

Gadag. See GARAG.

Gadames, GHADAMES, or RHADAMES, walled tn. and oasis, Tripoli, N. Africa, on the Tinghert plateau, 300 m. S.W. of Tripoli. The oasis produces dates, figs, and apricots. It is the ancient Cydamus, captured from the Garamantes by the younger Cornelius Balbus (*c.* 20 B.C.). Its population consists of Berbers, Arabs, and negro freedmen. Pop. 7,000.

Gadara, anc. tn., Syria, one of the Decapolis cities, E. of the Sea of Galilee. The 'country of the Gadarenes' is mentioned in Mark 5:1 in connection with the destruction of the Gadarene swine. About 100 B.C. it suffered the fate of other Greek cities east of Jordan, and was captured and partly destroyed by the Maccabæan prince Alexander Jannæus. The town was rebuilt by Pompey the Great in 63 B.C. About three miles to the north are the hot springs of Amatha (110° F.), much resorted to by the Bedouin.

Gaddi, a family of Florentine painters. (**1.**) GADDO GADDI (1260–1332), born at Florence, summoned to Rome in 1308 by Clement V., executed a number of works in mosaic. Four frescoes at Assisi are said to be from his hand. (**2.**) TADDEO GADDI (1300–66), born at Florence, son of the former, became a follower of Giotto. Among his works are a representation in fresco of the life of the Virgin, in the Santa Croce, Florence; a triptych of the Madonna, bearing date 1366, in the museum at Naples; and some frescoes at Pisa. Superior to his father in vigor, he is inferior to him in accuracy of drawing and in imaginative wealth. (**3.**) AGNOLO GADDI (*c.* 1330–96), son of Taddeo, depicted the story of the holy girdle of the Virgin in fresco, in the chapel of the Holy Girdle (della Cintola) at Prato. He also executed other frescoes at Florence, as, for example, in the church of the Holy Cross.

Gade, NIELS WILHELM (1817–90), Danish musical composer, a native of Copenhagen; first attracted attention in 1841 by a collection of overtures, afterwards published as *Echoes of Ossian*. Sent with a royal grant to study at Leipzig in 1843–8, he found a firm friend in Mendelssohn. He founded the conservatoire at Copenhagen, with Hartmann, in 1865. His orchestral compositions, which represent his best work, include an overture, *Michael Angelo*, and eight symphonies. He also produced several compositions for strings and some pianoforte pieces, besides cantatas, such as the popular *Spring Message*, *Spring Fantasy*, *Psyche*, *The Erl-King's Daughter*. He was one of the originators of the modern Scandinavian school of music.

Gades. See CADIZ.

Gadfly, a name given in the United States to the large black, or blue-black, blood-sucking 'horseflies' of the family Tabanidæ, called in Great Britain clegs or breeze-flies. They are powerful in flight, and the females are furnished with a lancet-like proboscis which can pierce the thickest skin. They are pres-

Common European Cleg, or Gadfly.

ent and dreaded by animals in nearly all parts of the world, and in Brazil are an even dangerous annoyance to man as well.

In Great Britain this name is usually applied to the bot-flies of the family Œstridæ. An example is *Hypoderma bovis*, of which the larvæ form bots or warbles. The adult fly deposits its eggs on the skin of cattle, where they hatch into maggots. The maggots bore through the skin and form tumors ('warbles') beneath it. When full fed they quit their host, fall to the ground, bury themselves, and after pupation emerge as flies. These, settling on cattle, cause them to gallop about in a frenzy in summer time. Other examples of the same family are the bot-fly of the horse

(*Gastrophilus equi*), for which see BOT-FLY. In the sheep bot-fly (*Œstrus ovis*), which has a similar life-history, the maggots enter the nostrils, and live in the frontal sinuses.

Gad fly.

1, Œstrus of horse; 2, of sheep; 3, of ox, with larvæ. (1 and 3 enlarged; 2, nat. size.)

Gadidæ, a family of bony fishes, to which belong cod, haddock, whiting, and other valuable food-fish. See the separate articles on these.

Gadsby, HENRY ROBERT (1842–1907), English composer, born at Hackney, London, was a chorister at St. Paul's Cathedral, an organist at a Surrey church, professor at Queen's College, Harley Street, London, and at the Guildhall School. His musical scores include symphonies, overtures, cantatas—some produced at the Crystal Palace and Philharmonic concerts—also church music (services and anthem). He published *Technical Method of Sight Singing* (1897).

Gadsden, tn., Ala., the co. seat of Etowah co., 60 m. N.E. of Birmingham, on the Coosa R., at the foot of Lookout Mt. It is an important commercial centre, being on the Chatt. S., the Louis. and Nash., the Nash., Chatt. and St. L., the S., and the Queen and Cress. R. Rs., and a river line to Rome, Ga. The manufactures include lumber, cotton, cotton-seed oil, piping, cars, etc. Iron and coal are mined in the district. There is also a large steel plant here. Gadsden was settled about 1843. Pop. (1940) 37,014.

Gadsden, CHRISTOPHER (1724–1805), American patriot, was born in Charleston, S. C., and was educated in England, whence he returned in 1741 to take a clerkship in Philadelphia. He was early on the popular side in the discontent with Great Britain, and was elected a delegate to the Congress at New York in 1765, which set forth the colonial grievances, especially against the Stamp Act. He was a member of the first Continental Congress in 1774, and urged the immediate expulsion of Gen. Gage from Boston. On the breaking out of the war he was promptly in the field, with the rank of colonel and was soon promoted to brigadier-generalship. He was active in the military defence of South Carolina, but as its lieutenant-governor signed the surrender of Charleston to Sir Henry Clinton in 1780. Although released on parole, Cornwallis subsequently ordered his arrest and detention for nearly a year at Fort Augustine. In 1781 he was set free on exchange. His age and infirmities led him to decline the office of governor of South Carolina, to which he was elected in 1782, but he still aided legislative affairs with his counsels.

Gadsden, JAMES (1788–1858), American soldier and diplomat, and grandson of Christopher Gadsden (q.v.), was born in Charleston, S. C. He graduated at Yale in 1808, and soon after joined the United States Army. His career during the War of 1812 was distinguished for bravery and efficiency. In the Seminole War he served as aide-de-camp to Gen. Jackson, and aided in the capture of the two Indian leaders, whose execution was the occasion of severe criticism and partisan bitterness toward Jackson. He served for a short time as aid to John C. Calhoun in the War Department, but acquired his chief renown in 1853 as minister to Mexico. In this capacity he negotiated a treaty with the Mexican Government by which the U. S. acquired control of a tract afterward organized into Arizona and New Mexico. For this tract, known as the 'Gadsden Purchase,' $10,000,000 was to have been paid, but changes in the treaty and a Mexican revolution put off the settlement until after Gadsden was superseded.

Gadsden Purchase. See GADSDEN TREATY.

Gadsden Treaty, a treaty between the U. S. and Mexico, signed Dec. 30, 1853, ratifications being exchanged on June 30, 1854. The negotiators were James Gadsden for the U. S., and Manuel Diez de Bonilla, José Salazar Ylarregui, and J. Mariano Monterde for Mexico. By this treaty the disputes, which grew out of the treaty of Guadalupe Hidalgo, concerning the boundary between the two countries, were settled, and the U. S. acquired an area of 45,535 sq. m. —an oblong square of land forming the southern part of what are now New Mexico and Arizona. This tract, known as the 'Gadsden Purchase,' was of little value for agricultural purposes, but was regarded as desirable for the reason that the projected Southern Pacific Railroad could find its best route through it. By the treaty the U. S. was also released from the onerous duty (imposed by the treaty of Guadalupe Hidalgo) of protecting Mexico from Indian incursions and of restoring Mexican prisoners captured by Indians—the U. S. paying for this release and for the new territory $10,000,000—and Mexico granted to the U. S. certain important privileges with regard to the transportation of mails and supplies across the Isthmus of Tehuantepec. For the text of the treaty see *Treaties and Conventions of the United States* (1889).

Gads Hill, in the village of Higham, 4 m. N.W. of Rochester, Kent, England, was the scene of Prince Henry and Falstaff's robber escapades, depicted by Shakespeare in his drama of *Henry IV.* Charles Dickens died at Gads Hill Place in 1870.

Gadski (Tauscher), JOHANNA (1871–1932), German soprano singer, born at Anclam, Prussia. Appeared at the Metropolitan Opera House in New York as Brunhilde in 1896. For several years she sang leading parts at the Metropolitan Opera House, but has recently devoted herself to concert tours, which have been very successful. As a singer of German Lieder she has succeeded Lilli Lehmann in popular esteem. In Europe she appears every year in opera at Bayreuth or at Munich. Her greatest parts are Brunhilde in the *Ring* trilogy, Eva in *Die Meistersinger,* and Senta in the *Flying Dutchman.*

Gadwall Duck.

Gadwall (*Chaulelasmus strepe-*

rus), a widely distributed duck, occurring throughout Europe and N. America, as well as in Asia and the north of Africa. It is a fresh-water species, and is remarkable for the great development of the comblike 'teeth' at the margin

Bill of Gadwall.

of the bill. It is 19–20 in. long, generally grayish, finely mottled, with the wing coverts chestnut, the breast ringed with white, and the under side of the wing pure white, while the speculum of the drake is blue. It breeds throughout the northern interior of N. America.

Gæa, or **Ge,** called **Tellus** by the Romans, the earth-goddess. She is said to have been the first offspring of Chaos, and she was the mother of Uranus (Heaven) and Pontus (Sea). Then she was wedded to Uranus, and bore to him the Titans.

Gaelic Language and Literature. *Language.*—Gaelic includes Irish and Manx as well as Scottish Gaelic, although in popular usage it is commonly restricted to the last. Gaelic, together with the Brythonic language (*i.e.* Welsh, the extinct Cornish, and the dialects of Brittany); Gaulish, which survives in words and names preserved by Latin and Greek writers as well as in inscriptions on stone and coins; and the dialect of Galatia in Asia Minor, of which hardly a vestige remains, constitute the Celtic language, which is a member of the great Indo-European or Aryan family. Gaelic joins with Greek in substituting *n* for the Aryan *m* as the termination of the accusative singular, the genitive plural, and the dative dual of nouns and adjectives; but its nearest relative in the Indo-European family is Latin. Celtic presents several features in its structure which some scholars have attributed to external non-Aryan influences. At an early date the Gaelic branch lost the initial *p;* for example, *pater,* 'father,' appears as *ath(a)ir.* Again, Celtic has developed the habit of sounding two or more words, when they are closely connected grammatically, under one accent, and treating them, phonetically, as one word. Under this influence the prepositions and their pronominal objects have become permanently welded into one word—*leam,* 'with me,' *leat,* 'with thee'—forms which find their analogue in the Tartaric languages. To the same cause are due other anomalies, notably the mutations known as initial aspiration and ellipsis, which students find so perplexing. A further feature, common in the Semitic languages, but in the Aryan family peculiar to Celtic, is that of placing two nouns, one of which governs the other in the genitive case, under one accent, and treating the combination as a compound noun; *Cuchulainn* 'the hound of Culann.'

The language was brought to Argyll (Scotland) by the Dalriadic colony which settled there in the beginning of the 6th century, but it was in the district at a much earlier date. The language became the speech of Strathclyde and Pictland. Gaelic continued to be the language of the Scottish court until Malcolm Canmore's day (1057–93), but from that time it has been slowly receding north and west. Of recent years a knowledge of English has penetrated into the remotest parts of the Highlands; but the old tongue is still spoken in corners of Aberdeen, Banff, Dumbarton, and Stirling, in considerable parts of Perth and Caithness, and over the whole of Arran, Argyll, Inverness, Ross, and Sutherland. In 1901 the number of persons over three years of age able to speak the language was 230,206, of whom 28,106 spoke Gaelic only. Highland emigrants carried the language to the United States, Canada, Australia, and New Zealand. It flourishes vigorously in parts of Canada, the only newspaper printed of recent years in Gaelic coming from Cape Breton. The language is largely preached in churches, but is not taught in the schools.

Literature.—The earliest Gaelic writings are found in Ireland, Wales, Devon, and Cornwall, cut on stone in the peculiar script known as Ogam. There is a continuous Gaelic literature from the 7th century. Much the greater part of this has been produced in Ireland. The memoranda in the *Book of Deer,* written in the 11th and 12th centuries, are the earliest existing specimens of Gaelic known to have been written in Scotland. A collection of the works of Irish and Scottish poets made by the Dean of Lismore (1512–30) is the oldest MS. which differentiates Scottish Gaelic from the literary language of scholars and bards. The Reformation effected a great cleavage between the Gaels of Scotland and the Gaels of Ireland in literature as in religion; but Scottish scholars continued to write in the old literary forms down to the middle of the 18th century, while, on the other hand, Duncan MacRae wrote the Fernaig MS. (1688–93) in the idiom of his native district of Kintail. The Gaelic MSS. preserved in Scotland are, with one or two exceptions, deposited in the Advocates' Library, Edinburgh. They contain a fair representation of the literature. The Scottish collection is very defective in the historical department. There are medical treatises, lives of saints, passions, homilies, and hymns. There are versions (they cannot in any sense be called translations) of the heroic literature of antiquity — of the *Discidium Trojæ,* the Argonautic expedition, the *Thebaid* of Statius, and the *Pharsalia* of Lucan. In purely native literature there is a fairly full vocabulary, and a copy of the grammatical treatise compiled by the old Gaelic scholars. The more important tales deal with the affairs of the Gaels themselves. These group round two centres—the first at the commencement of the Christian era, when Cuchullin is the great national hero; and the second in the 3d century, when Fionn MacCumhail is the principal figure.

Gaelic printed literature dates from 1567, when John Carsewell issued a translation of Knox's Liturgy. Until 1750 Gaelic publications were few, and were confined to religious works, versions of the Psalms in metre, catechisms, and confessions. In 1762–3 James Macpherson published *Ossian* in English, but the Gaelic text was not printed till 1807. In this work the old material is so entirely recast that one must regard Macpherson's *Ossian* as essentially modern. The *Sean Dana,* published by Dr. Smith in 1787, although not altered to the same extent, may be relegated to the same category. The genuine Ossianic ballads of manuscript and tradition were published in 1872 by J. F. Campbell in *Leabhar na Feinne.* The same author issued in 1860–2 his well-known *West Highland Tales.* By far the largest and most important section of modern Gaelic literature is what survives of the works of lyric poets who flourished from the 16th century to the present day. They abound in bold metaphor and happy imagery; they are charged with feeling, energy, and passion; and they show a fitting appreciation of the sublime and beautiful, especially in external nature. This body of verse is printed chiefly in the following collections: *The Book of the Dean of Lismore* (trans. by Maclauchlin, 1862); The Fernaig Collection—Cameron's *Reliquiæ Celticæ* (1894); R. Macdonald's (1776), Gillies's (1786), A. and D. Stewart's (1804), Turner's (1833), Mackenzie's *Beauties of Gaelic Poetry* (1841); Sin-

clair's *Gaelic Bards* (1890–6); and *An Duanair* (1879). With one exception, Mary Macleod, the works of the most highly prized Gaelic poets have been printed in separate volumes—as, for example, John Lom Macdonald, Alexander Macdonald, Dugald Buchanan, Robert Donn Mackay, Duncan Ban Macintyre, William Ross, Allan Macdougall, John Morrison, William Livingston, and Neil Macleod. Original Gaelic prose shows to great disadvantage, both in quantity and quality, in comparison with Gaelic poetry. Apart from one or two volumes of sermons, a history of Prince Charles Stuart by John Mackenzie, a well-written history of Scotland by the Rev. Angus Mackenzie, and an excellent collection of Gaelic proverb edited by Sheriff Nicolson, the bulk of it is scattered among periodicals. Among modern writers in this department Dr. Norman Macleod is easily first. Selections from his works have been printed under the title of *Caraid nan Gaidheal* (1868, 1901).

Several Gaelic dictionaries of value have been published, the best being Armstrong's (1825), the Highland Society's (1828), and Macbain's *Etymological Dictionary* (1866). There are also a number of grammars, the most useful of which are Stewart's (1812), Munro's (1843), and Forbes's (1848). See Pattison's *Gaelic Bards* (1866), Blackie's *Language and Literature of the Scottish Highlands* (1876), M'Neill's *Literature of the Highlanders* (1898), and Maclean's *Literature of the Celts* (1902) and *Literature of the Highlands* (1904).

Gaelic League, an organization founded in Ireland in 1893 mainly by two eminent Gaelic scholars, Douglas Hyde and Father O'Growney, to promote the study of the Gaelic language and literature. Its work represents a literary trend and aspiration connected with the wider Nationalist movement in Ireland, but it is also concerned with the renewal and encouragement of Gaelic studies in other countries. Chiefly through the influence of the League the Gaelic language is now taught in many of the Irish National and parish schools, as well as in higher institutions of learning so opposed in purpose and tradition as Trinity College, Dublin, and the Roman Catholic College of St. Patrick at Maynooth. An illustration of the changed attitude of the British government toward the movement is afforded by the encouraging statement regarding the teaching of Gaelic in the schools made in 1906 by the Right Hon. James Bryce, chief secretary for Ireland, in his place in parliament. In 1898 the League extended its work to the United States and Canada, and in 1903 there were between 50 and 60 branches. The visit and lectures of William Butler Yeats (q.v.) in 1903 and of Douglas Hyde in 1906 did much to increase American interest in Gaelic. Professorships in that language have been established in Harvard University, in the Catholic University of America at Washington, and in Notre Dame University, Indiana.

Gærtnera, a genus of tropical shrubs (Loganiaceæ). The beautiful Indian *G. racemosa* bears large, fragrant white flowers slightly tinged with pink.

Gætulia, anciently the interior of N. Africa, lying to the S. of Mauritania and Numidia and the region S. of the Syrtes. Its inhabitants were of the Libyan race, the ancestors probably of the modern Berbers. The Gætulians were conquered by Rome in 6 A.D.

Gaff, a light fishing-spear with a fork or hook at the end used for landing fish. A sort of boom used in fore-and-aft rigged ships for extending the upper end of sails is also called a gaff.

Gaffney, city, S. C., co. seat of Cherokee co., 50 m. W.S.W. of Charlotte, N. C., on the S. Ry. The chief manufactures are cotton, lime, and ginger ale, and the principal agricultural products of the district are cotton and the small grains. Tin ore and monazite are mined. The city owns and operates its water-works and electric light plant. It was settled in 1870. The battle-grounds of Cowpens and King's Mountain are in the vicinity. Limestone College, formerly Cooper Institute, was founded in 1845, and bought by Peter Cooper in 1880 and deeded to the Baptist denomination. Pop. 4,767.

Gage, Frances Dana Barker (1808–84), American reformer, daughter of Joseph Barker, born in Marietta, O., and married to J. D. Gage in 1829. She was almost from youth an enthusiastic advocate of the abolition of slavery, abstinence from liquor, and woman's suffrage. She was among the first to organize women's rights conventions, and her opening speech at one in 1851 attracted wide notice. Her removal to St. Louis in 1853 aroused the fierce opposition of a pro-slavery community, and her house was twice fired. During the Civil War she was a faithful agent of the Sanitary Commission, and in South Carolina had permanent charge of a large camp of freedmen. Her children's stories by 'Aunt Fanny' attained wide popularity.

Gage, Lyman Judson (1836–1927), American financier, was born in Madison co., N. Y., attended school at Rome, N. Y., and became a bank clerk there. In 1855 he found his way to Chicago, and after working as roustabout, watchman at a lumber yard, and teamster for three years, he secured a clerkship at the Merchants' Loan and Trust Company. In 1868 he was appointed cashier of the First National Bank, in 1882 he was its vice-president, and in 1891 its president. Under his management it became one of the strongest financial institutions in the West. His presidency of the World's Fair in 1892–93 brought him national reputation. Although a delegate to the Republican national convention in 1880, he supported Cleveland's candidacy in 1884, but declined his offered appointment to be Secretary of the Treasury in 1892. He accepted that office from McKinley in 1897, and retained it under Roosevelt until 1902, when he resigned to accept the presidency of the United States Trust Company of New York. In Chicago he was an active member of the Civic Federation for the improvement of its municipal government. After the Haymarket anarchist riot he founded the Economic Club for the discussion of social and economic subjects, which included in its membership capitalists, business and professional men, socialists, and labor unionists.

Gage, Thomas (*c.* 1578–1656), English Roman Catholic missionary, traveller, and author, entered the Dominican order in Spain, and from 1625–37 labored as a missionary in Mexico and Central America, and in 1648 published *The English American*, a glowing but shrewd description of the Spanish W. Indies. Sent as chaplain to Venables in 1654, he was at the capture of Jamaica, where he died.

Gage, Thomas (1721–87), English soldier and colonial governor of Mass., was born in Sussex, England. He was a lieutenant-colonel at the time of Braddock's expedition, during which engagement, although himself wounded, he contrived to rescue Braddock. He was in command of a provincial regiment in Abercrombie's unfortunate expedition against Ticonderoga. After the English capture of Montreal, Gen. Amherst appointed him governor of that city. In 1763 he was made commander of all the American forces, with headquarters at New York, where, in 1765, he surrendered on demand all the stamped paper. In 1772 he returned to England, but two years later he was ordered to Boston with four regiments to subdue the rebellious and discontented people of that colony. He was instructed to arrest and imprison the leaders

for treason and rebellion. At first he was conciliatory and was cordially received. Although ten years before he had refused to enforce the Stamp Act, on the ground that it would provoke civil war, he now began to enforce the Boston Port bill and other obnoxious measures. He threatened to punish severely the signers of the Solemn League and Covenant agreeing not to purchase British imports. His attempt to get possession of the arms and ammunition at Concord and Lexington 'fired the shot heard round the world.' In his report of the battle of Bunker Hill he confessed that 'the conquest of the country was not easy.' On its receipt in England, he was immediately recalled, and in 1782 was promoted to the rank of general.

Gagern, gä'gern, HEINRICH WILHELM AUGUST VON (1799–1880), German statesman, was born in Bayreuth. He was educated at Heidelberg, Göttingen and Jena, and entered on a public career as Minister of the Interior and Justice (1821). In 1836 he retired temporarily from political life, but in 1848 reappeared as the leader of the popular movement and was chosen president of the Frankfort first parliament. He bent all his energies towards effecting the union of Germany under a constitutional monarch, with the king of Prussia as emperor, and on the failure of the plan again withdrew from politics. In his later years he espoused the cause of Austria.

Gag-rules, in American history, a series of rules adopted, between 1836 and 1844, by the House of Representatives, for the purpose of contravening the right of petition as regards slavery. After the outburst of anti-slavery feeling which followed the establishment of the *Liberator* by Garrison in 1831, numerous anti-slavery petitions were presented to Congress, many of them praying for the abolition of slavery in the District of Columbia, over which Congress had jurisdiction. These petitions were at first received and referred to committees, but Southern members grew to resent more and more the offering of such petitions, and in May, 1836, the first gag-rule was adopted by the House. This rule prescribed that petitions relating to slavery should thereafter be laid on the table without being printed or referred, and asserted that Congress had no power, under the Constitution, to interfere with slavery in the States, and should not interfere with slavery in the District of Columbia. This rule and its successors were adopted despite the First Amendment to the Constitution, which prescribed that 'Congress shall make no law . . . abridging . . . the right of the people peaceably to assemble and to petition the government for a redress of grievances.' A rule, the 'Patton Resolution,' substantially similar to the first one, was adopted in December, 1837; in December, 1838, the so-called 'Atherton Resolutions' were adopted, condemning all attempts to secure the abolition of slavery in the District of Columbia and in the territories, and repeating the 'gag-rule'; and in January,1840, the House adopted its famous 'Twenty-first Rule,' to the effect that no petition praying for the abolition of slavery in the District of Columbia or in the territories or for the prohibition of the interstate slave trade would be received or would be considered in any way by the House.

Gahanbars, ge-hen-bärz', the six season festivals of the Parsees; during which Ormazd created the sky, water, earth, plants, animals, and mankind.

Gaia, gī'ya, VILLA NOVA DE, town, Portugal, in the province of Oporto, on the left bank of the Douro, 3 miles south of Oporto. It contains large storage vaults for port wine. Pop. (1920) 14,681.

Gail Hamilton. See DODGE, MARY ABIGAIL.

Gail'lard, DAVID DU BOSE (1859–1913), American military engineer, was born in Fulton, S. C. He was graduated from the U. S. Military Academy in 1884 and the Engineer School of Application in 1887. He was engaged on various river and harbor improvements; served in the Spanish-American war; was a member of the Panama Canal commission and supervising engineer of dredging in harbors, building breakwaters. He published *Wave Action in Relation to Engineering Structures* (1904).

Gailor, THOMAS FRANK (1856–1935), American Protestant Episcopal bishop, was born in Jackson, Miss. He was graduated from Racine College and the General Theological Seminary, New York City (1879) and was rector of the Episcopal church in Pulaski, Tenn. (1879–82). He served as professor of ecclesiastical history, vice chancellor, and chancellor of the University of the South and in 1898 became bishop of Tennessee. From 1919 to 1925 he was presiding bishop of the American Protestant Episcopal Church. His published works include *Manual of Devotion* (1887); *Things New and Old* (1891); *The Puritan Reaction* (1897); *The Episcopal Church and Other Religious Communions* (1904); *The Christian Church and Education* (1910); *The Episcopal Church* (1914).

Gaines, EDMUND PENDLETON (1777–1849), American soldier, was born in Culpepper County, Va. He entered the army in 1799, and in 1805 was made collector of customs at Mobile, Ala., where two years later he arrested Aaron Burr for conspiracy. Gaines was about to resign to practise law but on the outbreak of the War of 1812 he re-entered the army. For his defence of Fort Erie (August, 1814), he was brevetted major general. In 1817 he took an active part in the first Seminole War in Florida, and in the second Seminole War (1836) he was severely wounded at Ouithlacoochie. In the Mexican War his activity in raising recruits at New Orleans without authority led to his court-martial, but he was subsequently acquitted.

Gaines' Mill, BATTLE OF, a battle fought about 8 miles northeast of Richmond, on June 27, 1862, during the Peninsular Campaign of the Civil War, between a part of General McClellan's Federal army and a part of General Lee's Confederate army. The Federals under the immediate command of Gen. Fitz John Porter were stationed in a strong position on the north side of the Chickahominy River, where they were vigorously attacked by a greatly superior force of Confederates under Generals Longstreet, Jackson and A. P. Hill, and finally, toward nightfall, their centre was broken. During the night Porter withdrew to the south side of the Chickahominy.

Gainesville, city, Florida, county seat of Alachua County, on the Atlantic Coast Line, Seaboard Air Line, and the Tampa and Jacksonville Railroads; 60 miles southwest of Jacksonville. It is a popular winter resort. Alachua Lake, Newnan's Lake and the Devil's Mill Hopper are features of scenic interest in the vicinity. Manufactures include buggies, wagons, doors, sashes, blinds, and chemicals. Sea Island cotton, fruits, vegetables, and melons are the staples of the district, and phosphate and naval stores are shipped. The city was settled in 1856. It is the seat of the State University, and the Florida Winter Bible Conference is held here. Pop. (1910) 6,183; (1940) 13,445.

Gainesville, city, Georgia, county seat of Hall County, on the Gainesville and Northwestern, the Gainesville Midland, and the Southern Railroads; 50 miles northeast of Atlanta. It is situated in a farming and mining district with several mineral springs. It is the seat of Brenau College and Conservatory of

Music for young ladies and is visited as a health and summer resort. The manufactures include cotton, chairs, candy, flour, overalls, brick, leather, and lime. It was settled in 1821. Pop. (1910) 5,925; (1940) 10,251.

Gainesville, city, Texas, county seat of Cooke County, on the Colorado and Santa Fé, and the Missouri, Kansas and Texas Railroads; 73 miles northwest of Dallas. It is the trade centre of a stock raising and agricultural district and has manufactures of cotton-seed oil, flour, ice, ice cream, lumber, iron castings, cigars, candy, brick, and brooms. Pop. (1910) 7,624; (1920) 9,016.

Gains'borough, market town, England, in Lincolnshire, on the Trent, 15 miles northwest of Lincoln. Castle Hill, a tumulus, is erroneously said to be the tomb of King Sweyn the Dane and the old hall is said to have been built by John of Gaunt. Shipbuilding, engineering, seed-crushing, and manufacture of agricultural implements are carried on. Gainsborough, which is the St. Ogg's of George Eliot's *Mill on the Floss*, gives its title to the earldom in the Noel family. Pop. (1921) 19,694.

Courtesy The Art Institute of Chicago

BLUE BOY, BY GAINSBOROUGH

Gainsborough, THOMAS (1727–88), one of the most famous of English portrait and landscape painters, was born in Sudbury, Suffolk. Early in life he showed his artistic talents and was sent to London to study. In 1743 after an unsuccessful attempt to establish himself in Hatton Garden, London, he settled in Ipswich, where he obtained work through Philip Thicknesse, governor of Landguard Fort, afterwards his first biographer. At his suggestion Gainsborough moved to Bath in 1760, and soon became a fashionable painter. He was one of the thirty-six original members (1768) of the Royal Academy; but being offended by the poor position given to his *Three Princesses* in 1784, he withdrew, and never exhibited again. In 1774 he left Bath, and settled in London.

Gainsborough was the rival of Reynolds in portraiture, and of Richard Wilson in landscape. He, more than any other artist, should be called the father of modern English painting and his influence as first of the impressionists can be traced through all contemporary art—in Constable, in the middle-Victorian landscapists, in the Glasgow school, in the New English Art Club. The greatest colorist of the early British school, he was rapid and facile in execution, dignified and graceful in expression, absolutely true to life and nature, and essentially English in sentiment. He painted more than three hundred canvases, of which two hundred and twenty were portraits. Among his sitters were George III., Pitt, Burke, Clive, Franklin, Sterne, Johnson, Garrick, Sheridan, Mrs. Siddons, and the Duchess of Devonshire. The portrait of the latter was exhibited in 1793, and was subsequently bought by Thomas Agnew and Sons for £10,065. In 1876 the canvas was cut from the frame in their galleries by a thief, but was recovered in the United States in April, 1901, and is now in the Metropolitan Museum, New York. Among other notable Gainsborough portraits are his *Portrait of a Young Lady, Duchess of Gloucester, Mrs. Siddons, Perdita Robinson, Mrs. Graham*, and the *Blue Boy*, now in the Huntingdon Collection, California. A *Landscape with Figures* is in the Chicago Art Institute, and two *Landscapes, Mr. Burroughs*, and a *Child with Cat*, in the Metropolitan Museum.

Gairdner, JAMES (1828–1912), British historian, was born in Edinburgh and began life as clerk in the Public Record Office in 1846. His publications include *The Paston Letters* (1872–5, 1900); *Henry* VII., in the English Statesmen Series (1889); *History of Richard* III. (1878; new ed. 1898); *Letters and Papers of the Reign of Henry* VIII. (1863), and also of *The Reigns of Richard* III. *and Henry* VII. (1858);

Studies in English History (1881); *The Early Tudors* (1902); and *A History of the English Church in the 16th Century* (1902). He has edited a great part of the *Calendar of State Papers of Henry VIII.'s Reign.*

Gairdner, Sir William Tennant (1824–1907), Scottish physician, born in Edinburgh; was connected with the Royal Infirmary there (1846–62). In 1862 he was appointed professor of medicine in Glasgow University, retiring in 1900. He was hon. physician-in-ordinary to the king in Scotland. He published *Clinical Medicine* (1862), *The Physician as Naturalist* (1889), and *The Three Things that Abide* (1903), and was a frequent contributor to U. S. journals.

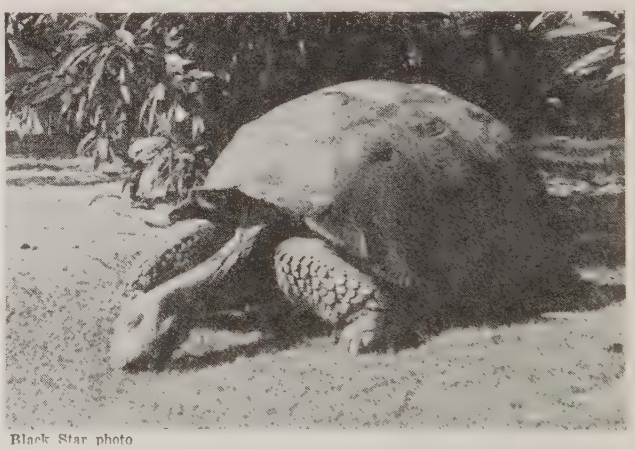
Gaisford, Thomas (1779–1855), English scholar, and dean (1831–55) of Christ Church, Oxford, was born at Ilford in Wiltshire. He became regius professor of Greek at Oxford (1812). As curator of the Bodleian Library, he did much to improve that institution; but he is best known as the editor of classical authors (Herodotus, Euripides, Sophocles, Cicero). The 'Gaisford prize,' for proficiency in Greek verse and prose, was founded at Oxford in his memory (1856). His chief works were the *Lexicon of Suidas* (1834) and the *Etymologicon Magnum* (1848).

Gaius, Roman jurist, who lived during the reigns of Antoninus Pius and Marcus Aurelius (138 to 182 A.D.), was the author of several works, all lost, except the *Institutes;* these were discovered by Niebuhr in 1816 at Verona. Perhaps a tenth part of the work is still missing. The *Institutes* form the best introduction to a study of the principles of Roman law. Editions: Krüger and Studemund (4th ed. 1900); Poste (1890), with translation and notes. See Glasson's *Etude sur Gaius* (1885), and Mackeldey's *Handbook of the Roman Law,* trans. (1883).

Gaj, Ljudewit (1809–72), Croatian publicist, born at Krapina. He identified himself with the nationalist movements of his countrymen. He made an attempt to form a common literary language, which he called Illyrian, by fusing the Servo-Croatian and Slovenish languages. He was the author of *Jos Hrvatska nij Propala* (1833), and founded the nationalist journals *Novine Hrvatske* (1835) and *Danica Ilirska* (1836). Gaj's best work was, however, a series of editions of the old Dalmatian classics.

Galactagogues, or Galactogogues, are agents which promote the secretion of milk. The most powerful of these is jaborandi, a South American drug, whose chief active constituent is pilocarpine. Many other substances, such as aromatic oils, senna, and other purgatives administered by the mouth, pass into the milk, and may to some extent stimulate secretion, but from their taste or their medicinal effect they are apt to disturb the child. The action of jaborandi, moreover, is only temporary; and of more importance than drugs in securing a good flow of milk is careful attention to the state of the patient's general health and diet.

Galago, the genus to which belong certain long-tailed lemurs, widely distributed throughout Africa. The galagos have large naked ears, which can be folded so as to lie close to the sides of the head; the foot, too, is remarkably long. One of the largest species is *Galago crassicaudata,* the thick-tailed galago of Mozambique and the Lower Zambezi, which is about the size of a cat.



Black Star photo

HUGE GALAPAGOS TURTLE

Galahad, in the Arthurian romances, is the son of Lancelot and Elaine. In the later Grail romances he replaces Perceval as achiever of the quest of the Holy Grail. See Grail and Lancelot du Lac.

Galapagos, a group of about a dozen volcanic islands in the Pacific, 730 m. w. of Ecuador, to which they belong. The chief are Albemarle, James, Indefatigable, Narborough, Charles, and Chatham. Area, 2,400 sq. m. The flora and the fauna are alike peculiar. The fauna, differentiated in the different islands, especially prompted and furthered Darwin's problem of the origin of species. Confined to the islands is a huge tortoise (*Testudo elephantopus*). Turtles of enormous size frequent the coasts. Of the twenty-five kinds of land birds described by Darwin, all but one are peculiar. Pop. 400. See Darwin's *Voyage of the 'Beagle'* (1840–3), and Wolfe's *Ein Besuch der Galapagosinseln* (1879).

Galashiels, parl. bur. and tn., Selkirkshire, Scotland, on Gala Water, 4 m. N.W. of Melrose; has woolen mills and hosiery factories. The manufacture of Scotch tweeds, to which the town owes its prosperity, was introduced about 1829. There is also a large tannery. Pop. 13,615.

Galata. See Constantinople.

Galatea. See Acis.

Galathea, a genus of decapod crustacea often called squat lobster. The body is lobster-like, but is broad and somewhat flattened, the tail being habitually carried in a strongly bent position. Several species occur on the northeastern Atlantic shores.

Galatia, anc. dist. of Asia Minor, consisting of parts of Phrygia and Cappadocia. It derived its name from the Galatæ, or Gauls, who invaded and settled in Asia Minor during the 3d century B.C. Augustus made Galatia a Roman province (see next article). The chief cities were Pessinus, Ancyra, and Tavium.

Galatians, The Epistle to the, one of the four greater epistles of Paul. Its authenticity has been generally accepted, but is questioned by the Dutch school (see Steck's *Galaterbrief,* 1888). It was written to the churches in Galatia (ch.1:2). Now Galatia may mean either (1) the district in Asia Minor inhabited by Gallic tribes, which Paul is supposed to have visited on his second missionary journey (Acts16 6); or (2) the Roman province Galatia, which embraced the towns of

Courtesy Yerkes Observatory

A GALAXY OR ISLAND UNIVERSE, KNOWN AS THE SPIRAL IN TRIANGULUM AND CONSTITUTING A MEMBER OF OUR SUPER-GALAXY

Super-galaxies are made up of galaxies, and are held in their positions by gravitation. The diameters of these systems measure approximately 2,000,000 light-years. Our galactic system is a member of a super-galaxy which is of moderate size and is composed of 50 to 100 island universes.

Antioch, Iconium, Lystra, and Derbe, where Paul founded communities in his first expedition (Acts 13, 14). The prevailing opinion has been that the epistle was intended for churches in the former district (the N. Galatian theory); but of late the brilliant advocacy of Prof. W. M. Ramsay (*The Church in the Roman Empire*, 7th ed. 1903; *St. Paul the Traveller*, 1895; *Com. on Galatians*, 1899) has gained much acceptance for the view that its destination was the churches in the southern part of the province (the S. Galatian theory). The most probable date for the epistle assigns it to Paul's sojourn in Ephesus (Acts xix.). Its purpose was to oppose the propaganda of certain Jewish agitators who had been trying, not without success to undermine the reputation and work of Paul. We can name only a few of the almost innumerable commentaries: Hilgenfeld (1852), Ellicott (1854), Jowett (1859), Lightfoot (1865), Meyer (1870), Lipsius (1892).

Galatina, tn., prov. Lecce, Italy, 17 m. by rail s. of Lecce, with trade in oil, wine, and cotton. Pop. 14,086.

Galatz (Roum. *Galâti*), tn., river port, and episc. see, Roumania, in Covurlui co., on the l. bk. of the Danube. It is built in the form of an amphitheatre; has iron, copper, candle, and soap industries; exports grain, meal, timber, and ships. But the trade is passing to some extent to Braila. Galatz is the seat of the Danube Commission. Here in 1789 the Turks defeated the Russians, and in 1828 the Russians the Turks. Pop. (1939) 102,232

Gala Water, riv. of Scotland, rises in the Moorfoot Hills and flows S.E. into the Tweed about 3 m. W. of Melrose. Its total length is 21 m.

Galax, a one-species genus of plants belonging to the order Diapensiaceæ. *G. aphylla* is a dwarf-growing perennial plant with coriaceous, bronzy, heart-shaped leaves, much used for decorative purposes, and small white flowers, borne in a spicate raceme at the apex of a tall leafless scape.

Galaxia, a genus of Cape bulbous plants belonging to the order Iridaceæ. The flowers are mostly yellow, the corolla being tubular at the base, but spreading out into limbs at the extremity of the petals.

Galaxy is a term used in astronomy to indicate a milky way or island universe: a group of stars separated from similar groups by vast stretches of starless space. The term has particular application to that enormous grouping of visible stars and reflecting nebulae which make up the Milky Way (q.v.), the galaxy in which the solar system is located. Our galaxy has had numerous appellations in the course of human history. In ancient times it was described as the path of Phaeton. To the American Indian, Patagonian, and Norseman it figured as a ghostly highroad frequented by the dead.

Galba, SERVIUS SULPICIUS (B.C. 3–69 A.D.), emperor of Rome from June, 68, to January, 69. He had a distinguished career under Tiberius, Caligula, Claudius, and Nero, being prætor in 20 A.D., governor of Aquitania, consul in 33, governor of Gaul in 39, when he gained victories over the Germans, governor of Africa in 45 and 46, and of Hispania Tarraconensis from 61 to 68. After the murder of Nero he took the title of Cæsar and went to Rome.

Galbanum, a yellowish-brown gum resin yielded by *Ferula galbaniflua* and other umbelliferous plants. It is imported from Persia and the Levant in the form of tears or drops, agglutinated or separate, with a bitter taste and distinctive odor; and is used in medicine, internally as a carminative, externally as an irritant. It was known anciently as an ingredient of a perfume (*vide* Exod. 30:34).

Galcha, a term applied by the Persians in a social sense to the primitive hill tribes of the Hindu-Kush, the Pamir, and the uplands stretching thence N. to the headwaters of the Syr Daria (Jaxartes). These rude agricultural groups, which probably represent the aboriginal neolithic populations of the highlands between the W. and E. Turkestan lowlands, appear to have been largely Aryanized in speech in prehistoric times, and nearly all speak archaic forms of the Aryan mother tongue, which have recently been constituted a separate (provisional) member of the Aryan family. The peoples of Galchic speech comprise the Yidoks of Chitral, the Siah Posh of Kafiristan, the Gors, Chilasi, and others of the Upper Indus basin, the natives of Sarakol, Wakham, Shignan, Munjan, Sanglich, and Ishkashim, with all others of the Zerafshan basin, except the Yagnobis of non-Aryan speech. The physical type is the so-called 'Alpine,' especially in its pronounced brachycephaly (short round head with cephalic index over 86), tall stature, brown, gray, and even blue eyes, *never oblique*, the long and slightly arched nose, oval face, and generally regular features. Topinard declares the Galcha and the Auvergnat skulls to be identical, while De Ujfalvy calls the Kohistan (Hindu-Kush) highlanders 'belated Savoyards.' See Topinard, *Revue d'Anthropologie* (1878), p. 706; Robert Shaw in *Jour. Assoc. Soc.*, vols. xlv. and xlvi.; P. Tomaschek, *Die Pamir-Dialekte* (1882); J. Van den Gheyn, *Les Langues de l'Asie Centrale* (1884); Biddulph. *The Tribes of the Hindo Koosh* (1880); Ch. de Ujfalvy, *Les Aryens au Nord et au Sud de l'Hindou-Kouch* (1896).

Galdos, BENITO PEREZ. See PEREZ GALDOS.

Gale. See STORM.

Gale, NORMAN ROWLAND (1862), English poet and reviewer, born at Kew. His earlier poems, which were issued privately in pamphlet form between 1888 and 1891, include *Anemones*, *Cricket Songs*, *Meadowsweet*, and *Violets*. Two series of charming lyrics, under the title of *A Country Muse*, followed in 1892, and his later volumes include *Orchard Songs* (1893), *A June Romance* (1894), *Songs for Little People* (1896), and *Barty's Star* (1903).

Gale, THEOPHILUS (1628–78), English nonconformist divine, born at Kingsteignton, Devonshire; became preacher at Winchester Cathedral (1657). Refusing to comply with the Act of Uniformity, he was ejected. He was afterward a tutor (1661–6), and finally preacher at a dissenting chapel in Holborn. In his *Court of the Gentiles* (1669–77) he traces all languages to Hebrew. He also wrote *A True Idea of Jansenisme* (1669).

Gale, THOMAS (?1635–1702), English classical scholar and antiquary, born at Scruton, Yorkshire; became successively master of St. Paul's School (1672–97) and dean of York (1697–1702). He was regius professor of Greek at Cambridge (1666–72), and first hon. secretary of the Royal Society.

Galeandra, a genus of deciduous, terrestrial, tropical American orchids. Among the most beautiful species are *G. nivalis* and *G. Baueri lutea*.

Galega, or GOAT'S RUE, a genus of hardy leguminous plants with white or blue papilionaceous flowers borne in racemes. The leaves are pinnate, and the leaflets entire. The most common species is *G. officinalis*, a blue-flowering plant about four feet high, with its beautiful white variety.

Galen (130 to about 200 A.D.), ancient physician, whose full name was Claudius Galenus; was born at Pergamos in Asia Minor. In 163 or 164 he went to Rome, and gained great renown in that city, and attended the Emperors M. Aurelius and L. Verus at Aquileia. His life was then spent alternately at Rome and Pergamos. The date of his death is unknown. For many centuries his writings formed the

chief text-book of the medical profession. He was especially distinguished in anatomy, diagnosis, and prognosis. For his principal contributions to medical science see MEDICINE.

Galen was a voluminous writer not only on medical, but also on philosophical subjects, as logic, ethics, and grammar. His most important anatomical and physiological works are *De Anatomicis Administrationibus*, and *De Usu Partium Corporis Humani*. A considerable number of his writings are still extant. Editions include those of Marquardt, Müller, and Helmreich (in Teubner's series). Consult also J. Finlayson's *Galen;* J. F. Payne's *Harvey and Galen;* Maillard's *Aperçu Historique sur Galen et ses Ouvrages;* Coxe's epitome in English of Daremberg's *Exposition. . . de Galien sur l'anatomie.*

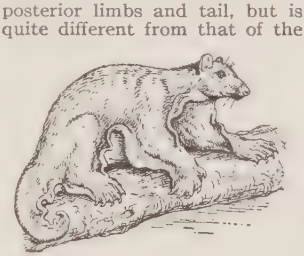
Gale'na, or LEAD-GLANCE, the naturally occurring sulphide of lead, PbS, the source from which the metal lead is almost entirely obtained. It is very widely distributed, and occurs massive and, more commonly, in heavy (sp.gr. 7.5) cubic crystals of a bright lead color that are brittle ($h. = 2\frac{1}{2}$), and readily cleave into smaller cubes. It is somewhat volatile and easily oxidized, lead being set free under suitable conditions. Pure galena contains 86.6 per cent. lead, but there is often an admixture of antimony, gold, and silver. There are abundant deposits in Illinois, Iowa, Missouri, and Wisconsin in the United States, and in Great Britain, France, Germany, Sweden, Switzerland, and elsewhere in Europe. See LEAD.

Galena, city, Illinois, county seat of Jo Daviess county, on the Galena River, three miles from its confluence with the Mississippi, and on the Chicago and North Western, the Chicago, Burlington and Quincy, and the Illinois Central Railroads, and on the Grant Highway (State route no. 5); 145 miles northwest of Chicago. Features of interest are the public library, customs house, Grant Memorial Home, and Grant Park. Industries include foundries and machine shops, a condensed milk factory, flour mills, and manufactures of motor trucks, ice cream, artificial ice, cigars, gloves and mittens, and axle grease. Lead (galena) and zinc are extensively mined; smelting is carried on, and there are farming and dairying interests. Galena was the home of General Grant for several years prior to the Civil War. Pop. (1910) 4,835; (1920) 4,742.

Galena, city, Kansas, Cherokee county, in the extreme southeastern corner of the State, on the Missouri, Kansas and Texas, and the St. Louis-San Francisco Railroads; 53 miles south of Fort Scott. It is the seat of Spring River Academy. It is the centre of a lead and zinc mining district, and has smelters and stamping works. Pop. (1910) 6,096; (1920) 4,712.

Galeodes, gā-li-ō'dēz, a genus of Solipugæ, an order of arachnids sometimes called 'false spiders' or 'scorpion spiders.' The species are abundant in hot countries, and are poisonous. In Southern Russia *G. araneoides* is common; there is also a Greek species (*G. græcus*), and another in Portugal. An obvious distinction from true spiders is the fact that both thorax and abdomen are segmented.

Galeopithecus, gā-li-ō-pi-thē'kus, the generic name of certain mammals from the Malayan region, commonly, though incorrectly, called flying lemurs. The two species of Galeopithecus are now placed in a sub-order of Insectivora, and regarded as the vegetarian analogues of the insect-eating bats. The common species, *G. volans*, is about the size of a cat, and, like its ally, *G. philippinensis*, has a flying-membrane or parachute, which involves the anterior and posterior limbs and tail, but is quite different from that of the



Galeopithecus

bats. The teeth are remarkable, the lower incisors being comb-like, while the upper outer incisor at each side has two roots. The animals feed upon leaves and fruit, and are said at times to eat eggs, insects, and even small birds. They are nocturnal in their habits and entirely inoffensive. Though incapable of true flight, they can take long flying leaps.

Galeopsis, gā-li-op'sis, a genus of hardy annual plants, native to Europe, and naturalized in the United States. The commonest kind is *G. tetrahit*, the hemp-nettle, which blooms from June to August. This species grows to a height of one to three feet, has long-pointed, bristly haired leaves, and pink or purplish flowers. *G. versicolor* has large yellowish flowers with a reddish or purplish spot on the lower lip of the corolla.

Galeotto Principe, gä-lā-ot'tō prin'chē-pā, a name given to Boccaccio's *Decameron.*

Galerius, *ga*-lē'ri-us (d. 311). Galerius Valerius Maximianus, a Roman emperor, was born of humble parentage, near Sardica, in Dacia. Entering the imperial army, he rose rapidly to the highest ranks. In 292 Diocletian conferred on him the title of Cæsar, and gave him his daughter in marriage. In 296–97 he conducted a successful campaign against the Persians. On the abdication of Diocletian (305) he and Constantius Chlorus became joint-rulers of the Roman empire, Galerius taking the eastern half. He retained possession of the east till his death in 311. Galerius is believed to have forced Diocletian to issue his famous edict of persecution against the Christians.

Gales, JOSEPH (1786–1860), American journalist, was born in Eckington, England, son of a printer—also Joseph Gales (1760-1841)—whose democratic ideas forced his emigration to the United States in 1793. The younger Gales was graduated from the University of North Carolina, learned the printing trade in Philadelphia, and in 1812 formed a partnership with his brother-in-law, Seaton, for the publication of the *National Intelligencer* at Washington. Gales and Seaton for many years were the sole reporters of the debates in Congress, and to them the preservation of the famous debate between Webster and Hayne, with Webster's editing and correction, is due. The debates from 1798 to 1824 were published in forty-two volumes, entitled *The Annals of Congress*, and from 1824 to 1837 in twenty-nine volumes, entitled *Register of Debates in Congress*, popularly known as *Niles' Register*. The fact of Gales' English birth so provoked the British Admiral, Cockburn, when he captured the capital, that he burned and destroyed Gales' whole plant and a valuable library.

Galesburg, city, Illinois, county seat of Knox county, on the Chicago, Burlington and Quincy, and the Atchison, Topeka and Santa Fe Railroads; 50 miles northwest of Peoria; and 163 miles west of Chicago. It is the seat of Knox College (q.v.), founded in 1837, the scene of a famous debate between Lincoln and Douglas in 1850; and of Lombard College. It has also three Catholic schools, a public library, and two city hospitals. There are extensive railroad shops here and manufactures of engines, farm machinery, and paving bricks. According to the Federal Census for 1937, industrial establishments number 38, employing 958 wage earners, with products valued at $6,512,663.

The town was founded in 1836 by pioneers from New York and Vermont, led by Rev. George W. Gale, whose plan it was to found a college 'to spread the gospel throughout the world.' Pop. (1900) 18,607; (1910) 22,087; (1940) 28,911.

Gale'ton, borough, Pennsylvania, Potter county, on the Buffalo and Susquehanna Railroad; 148 miles northeast of Pittsburgh. It has railroad repair shops, a tannery, milk condensery, silk mill, glove factory, ice cream factory, and novelty works. The Gaines oil fields are four miles distant. (1910) 4,027; (1920) 2,969.

Galiani, gä-lya'nē, FERNANDO (1728–87), Italian political economist, was born in Chieti, in the Abruzzi. He was educated in Naples, and in 1750 established a reputation both abroad and in his own country by his treatise *On Currency* (*Della Moneta*). In 1759 he was appointed secretary of legation in Paris, and while there wrote his *Dialogues on the Corn Trade* (1770), which met with great success. Returning to Naples, he was appointed minister of the royal domains (1777) and first assessor of the council of finance (1782). Among his other works are a treatise *On the Reciprocal Duties of Neutrals and Belligerents, Letters to Madame d'Epinay* and a *Life of Horace* (in manuscript). Consult Alberto Marghieri's *L'Abate Galiani* and Dessein's *Galiani et la Question au XVIIIe Siècle.*

Galicia, *ga*-lish'i-*a*, a former crown land of Austria, which was given to Poland by the Peace of St. Germain (1919). It is bounded on the south and southwest by the former nation of Czecho-Slovakia, on the east by the Russian Ukraine and on the west it is bounded by the Prussian states of Silesia and Moravia. It was the largest of the Austrian crownlands, having an area of 30,307 square miles. The surface is mountainous, with rolling plains towards the north, and is drained by the Vistula, Dniester, Pruth, Bug, and Sereth Rivers. The climate is temperate on the whole, with long severe winters and hot summers.

There is some mineral wealth, of which salt is the most important. Petroleum is also obtained in large quantities, and petroleum refineries are numerous. Coal, iron, lead, and zinc occur in limited amounts. Agriculture is the chief industry, engaging more than three-fourths of the population. The soil is for the most part fertile, and produces oats, rye, barley, wheat, flax, hemp, and tobacco. Fruits and vegetables are raised, beekeeping is carried on, and herds of cattle, sheep and horses graze on the hillsides. About one-fourth of the land is covered with forests, and timber is exported, particularly to Germany. Manufacturing industries are few and unimportant; they include weaving, distilling, and brewing.

The estimated population in 1935 was 7,500,000, of whom nearly 50 per cent. were Poles, 38 per cent. were Ruthenians, and the rest Germans, Bohemians, Moravians, and Slovaks. The Ruthenians belong mostly to the Greek Catholic Church and the Poles to the Roman Catholic. Jews number about 10 per cent. of the population. Lemberg (317,700) is the largest city. Other important towns are Cracow (254,600) and Przemysl (51,000). Education is in a backward state and illiteracy is prevalent. There are universities for higher education at Lemberg and at Cracow.

In the ninth century Ruthenia, which comprised Galicia and Lodomeria, with Kiev as its capital, rose to a position of great power. In the twelfth century, following its pillage by the Muscovites, Kiev was destroyed by the Tartars and Russian refugees from that city settled in Galicia, which became one of the greatest of Russian principalities. In 1340 Casimir II. of Poland claimed the country in the right of his mother; Olgeird of Lithuania also claimed it, and a compromise was effected whereby Poland acquired East Galicia with Lemberg, and Lithuania had the rest. Some forty years later, by the marriage of Queen Hedwig to Jagiello, Grand Duke of Lithuania, Poland was united to the Lithuanian Empire, and until 1772 Galicia formed a part of that state. By the first partition of Poland (q. v.), it was annexed to Austria.

In 1809 Napoleon made a treaty with Austria by which she ceded to him Western Galicia including Cracow and the southeast corner of Old Galicia. The Old Galician territory was given by him to Russia, and West Galicia and Cracow were added to the Duchy of Warsaw. East or Old Galicia was regained by Austria in 1814, and Cracow was annexed in 1846 and incorporated in Galicia.

During the Great War of Europe (q. v.), Russian armies invaded Galicia, early in 1915, and gained the passes of the Carpathians but were driven out by Von Mackensen. The following year they returned to the attack and penetrated as far as Halicz; in July, 1917, fighting was once more resumed, in the vicinity of Lemberg, but the revolution which had taken place in Russia a few months earlier had so weakened the *morale* of the army that the Russian troops were soon routed and with the treaty of Brest-Litovsk (q. v.) Russia's part in the war ceased. A further struggle between the Ukrainians and Poles over East Galicia ended in 1919 with the Polish triumphant. Following the Nazi conquest of 1939, Galicia was partitioned between Russia and Germany. See EUROPE, GREAT WAR OF; POLAND; WORLD WAR, THE SECOND.

Galicia (Span. pron. gä-le'-thē-ä), formerly a kingdom, later a province of Northwestern Spain, bounded on the north by the Bay of Biscay, on the east by Asturias and León, on the south by Portugal, and on the west by the Atlantic Ocean. It has an area of 11,256 square miles, and has been divided since 1833 into the four provinces of Corunna, Pontevedra, Orense, and Lugo. Isolated peaks, hills, and valleys constitute the general topographic features and have won for the district the name of the Spanish Switzerland. The principal rivers are the Lima, the Minho, the Sar, the Tambre, the Cabe, and the Eo. On the coasts are some of the finest harbors in Europe, as Vigo and Ferrol. The climate is diversified and there is abundant rainfall which causes great humidity and a remarkably fertile soil.

Woods of oak and chestnut cover the hillsides, and pines crown the mountain peaks; wheat, maize, rye and tobacco thrive in the valleys. Fruits of all kinds, olives, figs, potatoes, and cabbages grow on the slopes of the hills; herds of cattle graze on the plains; and vine growing is everywhere carried on. Slate, copper, gneiss, and iron are found in the mountains, and there are many mineral springs.

The inhabitants, called Gallegos, are an exceedingly sturdy and patriotic people, but, owing to the density of population and the pressure of taxes, emigration to Portugal and to South America is exceedingly heavy. The population numbers more than two millions.

There were Phœnician colonies in Galicia in the twentieth century B.C., but the earliest documentary information concerning the region comes from the Romans. In 131 B.C. Brutus attempted its conquest. He succeeded in penetrating only as far as the river Minho, and it was not until the first century A.D. that Augustus made Galicia a Roman province. In the fifth century it was overrun by the Suevi, and they, in turn, were driven out in 585 by Leovigild, king of the Goths, who made himself lord of the province. Gothic rule ended when the

Saracens entered Spain in 709 and defeated Roderick the Visigoth. In the tenth century Alfonso III. achieved a temporary victory over the Moslems, and Galicia fell to his son Ordoño. On the death of Ferdinand the Great, in 1065, it came into possession of his son Garcia; after long civil strife Garcia's brother Alfonso VI. annexed it to his domains and it became an integral part of the kingdom of Castile or of León.

Galignani, gä-lē-nyä'nē, JOHN ANTHONY (1796–1873) and WILLIAM (1798–1882), French publishers of *Galignani's Messenger*, issued daily at Paris in English, were born in London, of Italian parentage. The *Messenger*, founded in Paris by their father in 1814, with the object of strengthening the ties between France and England, was carried on by the brothers after 1821. They founded a home for Englishmen in need at Corbeil, near Paris.

Gal'ilee (Galîl, 'a ring or circle'). The Galilee of the Gentiles was a province in Palestine lying north of Samaria, with the valley of the Jordan on the east and the Phœnician coast on the west. It measures about 50 miles from north to south, and 35 miles from east to west, with an area of about 1,600 square miles. It included the Jordan valley, with the Lake of Galilee; the plain of Esdraelon in the south; Lower Galilee; and Upper Galilee. The soil in this region is exceedingly fertile; and olives, wheat, barley, maize, figs, melons, apricots, and pears are grown. The land was formerly extensively cultivated by a population which Josephus reported to be nearly 3,000,000, but which was probably nearer to 400,000. Galilee was anciently a great thoroughfare: through it passed the *Way of the Sea*, from Damascus to the Mediterranean; the Great South Road, to Egypt; and the Great Road of the East, to Arabia.

Galilee of New Testament times was mainly inhabited by Syrians, Phœnicians, Arabs, and Greeks, with a few Jews. The principal towns were Tiberias and Sepphoris; those that figure in the gospels are Cana, Capernaum, Nazareth, and Nain. The Jewish inhabitants were held in low estimation in Judea, on account of their less rigid religionism. After the destruction of Jerusalem Galilee became the refuge of the doctors of Jewish law, and Tiberias the seat of Rabbinical learning. The ruins of many synagogues are still extant in this region. In modern times Galilee has formed part of the pashalic of Damascus. It still has a number of Jewish inhabitants. Consult Merrill's *Galilee in the Time of Christ.*

Galilee, in old English churches, a porch or external chapel used by persons (*e.g.*, penitents) not admitted to the church itself, being sometimes assigned to women where, as at Durham, these were excluded from the general services. Examples are to be seen at Durham (a gem of architecture), Ely, and Lincoln.

Galilee, Lake of, also known as the SEA OF GALILEE, SEA OF TIBERIAS, and LAKE OF GENNESARET, a lake in Palestine, in the eastern part of the province of Galilee (q. v.), closely associated with the life and ministry of Christ. It is about 13 miles long by 8 miles wide and roughly harp-shaped. It occupies a trench 680 feet below the level of the Mediterranean and is enclosed, except on the south, by high hills. On the eastern shore a narrow strip of beach separates the mountains from the sea; on the west the wider plain of Gennesaret intervenes. To the south lies the deep valley of the River Jordan, which passes through the lake from north to south. The water is sweet and abounds in fish. Sudden and violent storms occur.

During the life of Christ the Sea of Galilee was the focus for the whole province. Great woods looked down from the mountain slopes that are now barren; fleets of vessels moved

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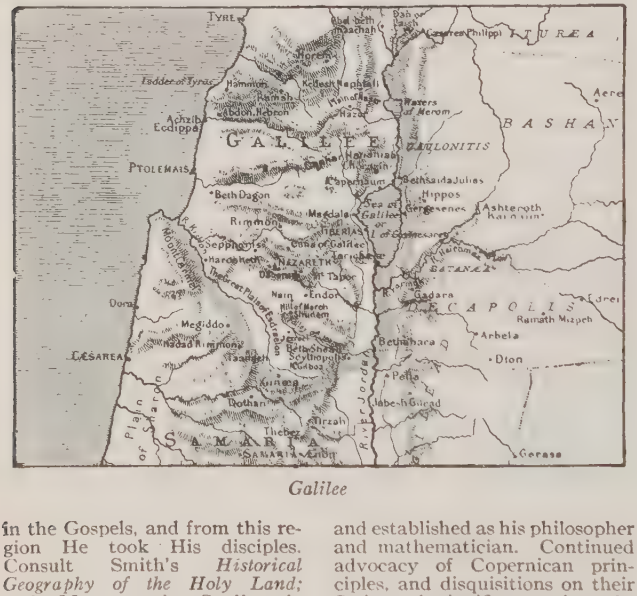
The Sea of Galilee

In the foreground is the little town of Tiberias, the only one of the great lake cities remaining to-day.

on the waters, where to-day a sail is seldom seen: and palms, fig and olive trees, and a wealth of flowers and ferns clothed the fertile shores. There were at least nine cities around the Lake. Of these the sites of Tiberias and Magdala on the western shore, and Gardara and Hippos on the eastern are known. Bethsaida and Capernaum were to the north and Gamala probably to the east; the location of Tarichæa and Chorazin is still a matter of controversy. The industries of the region were agriculture, fruit raising, dyeing, tanning, fishing, boat building, and fish-curing. To-day only the little town of Tiberias, with some 5,000 inhabitants, remains.

Around the northern part of the Lake Christ passed the greater part of His public life and ministry. It was the scene of many of His miracles, as told



Galilee

in the Gospels, and from this region He took His disciples. Consult Smith's *Historical Geography of the Holy Land;* and Masterman's *Studies in Galilee.*

Galilei, gä-le-lā'ē, GALILEO (1564–1642), Italian astronomer and physicist, was born in Pisa, son of Vincenzo Galilei, a mathematician of some note. He entered the University of Pisa, and while a student there enunciated the law of vibrations or swings of a pendulum—*i.e.*, its isochronism (1583). About this time, also, he invented a hydrostatic balance and wrote a treatise on the specific gravity of solid bodies. In 1588 he secured a professorship in mathematics at the University of Pisa and while there propounded the theorem that all falling bodies descend with equal velocity. This he proved by several experiments conducted from the top of the famous Leaning Tower. The hostility of the Aristotelians was aroused by such 'heresy,' and in 1591 Galileo quitted Pisa, and obtained the professorship of mathematics in Padua University (1592–1610), whither his lectures attracted pupils from all Europe. In 1609 he constructed a telescope, on the model of that of Hans Lippershey of Middleburg in Holland, and with it discovered four satellites of Jupiter, which he ascertained were not stationary, but actually revolved around the planet. He also demonstrated the uneven configuration of the surface of the moon, and he detected sunspots, from which he inferred the rotation of the sun.

In 1610 Galileo was invited to Florence by his patron, Cosimo, Grand Duke of Tuscany, and established as his philosopher and mathematician. Continued advocacy of Copernican principles, and disquisitions on their Scriptural significance, brought him under the ban of the church, and he was cited to appear before the Inquisition (1616). The Holy Office decreed the new theory of the solar system to be philosophically absurd, and bade him discontinue his teaching; at the same time, Copernicus' book on the subject was interdicted. Galileo promised (February 26, 1616) to obey this injunction, thenceforward not to 'hold, teach, or defend' the condemned doctrines. But in 1632, ignoring his pledge, he published the *Dialogo sopra i due massimi Sistemi del Mondo.* Pope Urban VIII. was led to believe that Galileo had satirized him in this work. In spite of his seventy years and heavy infirmities Galileo was again summoned before the Inquisition, and, after a wearisome trial and incarceration, was condemned to abjure by oath on his knees the truths of his scientific creed. Since the year 1761 a legend has been current to the effect that on concluding his recantation he exclaimed, *sotto voce,* 'E pur si muove' (Nevertheless it does move). In his retreat at Arcetri, near Florence, he continued with unflagging ardor his learned researches, even when hearing grew enfeebled and sight was extinguished. Just before he became totally blind, in 1637, he made yet another important astronomical discovery, that of the moon's monthly and annual librations.

He died Jan. 8, 1642, and was buried in the Cathedral of Santa Croce. An edition of his works and correspondence, including what is perhaps his most important production, *Dialogues of the New Sciences* (first pub. 1638), has been issued by the Italian government (1890-1909). Consult also *Lives* by Viviani, T. Henri Martin, Favaro, and Fahie.

Galion, city, Crawford county, Ohio, on the Erie and Cleveland, Cincinnati, Chicago, and St. Louis Railroads; 55 miles northeast of Columbus. There are large railroad shops here, and manufactures of buggies, wheels, metallic vaults, etc. Grain is raised in the surrounding district. The 'Crawford massacre' took place here. Pop. (1900) 7,282; (1930) 7,674.

Galitzin, gä-lits'ēn, also GALLITZIN, GOLIZYN, and GALIZYN, a prominent family of the Russian nobility. Among the most important were: (1) VASILI VASILJEVITCH, surnamed 'the Great' (1643–1713), was head of the army and keeper of the great seal under Sophia, sister of Peter the Great. His fall, caused by his ambition to obtain the crown, was followed by banishment to the far north. (2) MICHAEL MICHAELOVITCH (1674–1730), won distinction in the wars of Peter the Great against Turkey and Sweden, and especially by the conquest of Finland (1714). (3) DIMITRI ALEXEJEVITCH (1735–1803) served as Russian ambassador to The Hague and Paris, where he formed friendships with Voltaire and the Encyclopédistes. He is most widely known through his wife ADELHEID AMALIE (1748–1806), daughter of Count von Schmettau, a Prussian general. She gathered, at various times, Goethe, Jacobi, Fürstenberg, Hemsterhuis, and Hamann in her house at Münster, where she settled after separating from

GALILEO BEFORE THE INQUISITION
From an old print.

Courtesy The Art Institute of Chicago

GALILEO'S STUDY AT FLORENCE

her husband. (4) NIKOLAI SERGIEVITCH (1808–92) was lieutenant-general in the Russian army, and wrote a history of war, translated into German as *Kriegsgeschichte seit den altesten zeiten* (13 vols., 1874–89), and other historical works. For Demetrius Augustin Galitzin, see GALLITZIN.

Gallium, gā'li-um, popularly known as Bedstraw, a genus of hardy plants having four-angled stems and bearing cymes or panicles of small flowers. It includes *G. verum*, the yellow bedstraw; *G. mollugo*, the hedge bedstraw; *G. aparine*, known as goose-grass or cleavers; *G. lanceolatum*, the wild licorice; and *G. latifolium*. See BEDSTRAW.

Gall. See BILE.

Gall, or GALLUS, ST. (A.D. 551–646), a saint of Irish origin, often called 'the apostle of the Alemanni.' He was a pupil of St. Columban at Bangor in Ireland; then settled in Switzerland near Lake Constance. The Swiss canton and town of St. Gall take their name from him.

Gall, FRANZ JOSEPH (1758–1828), German physiologist and founder of phrenology, was born near Pforzheim in Baden. Having established himself as a physician in Vienna (1785), he began his phrenological researches, presenting the results of his studies in a series of lectures. The continuance of these lectures having been forbidden by the government in 1802, he left Vienna and in 1807 settled as a physician in Paris, where he remained until his death. There he published his *Introduction au cours de physiologie du cerveau* (1808), *Recherches sur le système nerveux . . . et celui du cerveau* (1809), and the first part of *Anatomis et physiologie du système nerveux . . . et du cerveau* (1810–20; Eng. trans. by Lewis, 1835), the two latter works bearing also the name of his pupil Spurzheim. A reprint of a portion of the *Anatomie et physiologie* bearing the name of Gall alone was issued in 1825 (Eng. trans., 6 vols., *On the Functions of the Brain and each of its Parts*, 1835). In 1812 he published *Des dispositions innees de l'âme et de l'esprit* in answer to charges brought against him of materialistic teaching. The ultimate value of Gall's phrenological ideas is slight, but his books were useful in directing scientific attention to the brain and its functions. Consult *Life* by Jessie Fowler.

Gallagher, gal'*a*-ger, WILLIAM DAVIS (1808–94), American journalist and poet, was born in Philadelphia, Pa., the son of an Irish refugee. When his father died, the family removed to Cincinnati, O., where Gallagher began work in a printing office. He edited small papers at Xenia and Cincinnati, and also the *Western Literary Journal* and the *Hesperian*, to which he contributed verse and fiction, and which had an important influence in the literary development of the West. After holding other editorial positions until 1839, he became associate editor of the Cincinnati *Gazette*, with which he remained until 1850. He was connected with the Louisville (Ky.) *Courier* for several years, and lived in Louisville and vicinity from 1853 until his death. He published *Erato*, a three-volume collection of his poems (1835–7), *The Area of Subsistence and its Natural Outlet* (1879), *Miami Woods*, and *A Golden Wedding, and Other Poems* (1881).

Gallait, gà-lā', LOUIS (1810–87), Belgian painter, was born in Tournai, and first achieved fame through his pictures, *Render unto Cæsar the Things which are Cæsar's* (1832) and *Christ Healing a Blind Man* (1833), the last now in the cathedral at Tournai. He afterwards achieved a notable success in Paris as a historical and portrait painter. His chief historical works are *The Abdication of Charles V.* (1841), *Egmont Preparing for Death* (1848), *Alva Looking upon the Bodies of Egmont and Horn* (1851), *The Last Moments of Count Egmont* (1858), and *The Plague of Tournai* (1882). His *Minstrel Boy* and *The Prisoner* are in the Metropolitan Museum, New York City.

Galland, gà-läṅ, ANTOINE (1646–1715), French orientalist and archæologist, was born in Rollot (Picardy). He became attached to the French embassy at Constantinople in 1670, and in 1673 travelled in Syria and the Levant. He made other expeditions to the East in 1676 and 1679, and in 1704–17 published *Les mille et une nuits*, the first European translation of the *Arabian Nights*, which remains the standard French version. Among his other works is *Paroles remarquables, bons mots et maximes des orientaux* (1694).

Gal'la Ox, or SUNGA (*Bos indicus*), a species of humped cattle found in Central Africa. It has exceedingly thick horns and a hump on the withers such as is seen in all the domesticated cattle of India, China, Africa, and Madagascar.

Gallarate, gäl-lä-rä'tā, town, Italy, in the province of Milan, 25 miles northwest of the city of Milan. It has cotton and linen factories and manufactures of machinery and vehicles. Pop. (1921) 16,000.

Gallas, gä'läs, an Ethiopian people of Eastern Africa, ranging from Abyssinia in the north to the Tana River in the south. They are a pastoral people, but somewhat warlike owing to their environment. The men are tall and muscular, and though they are thick-lipped and of brown complexion, their features point to a Caucasian origin. The women in the eastern parts are fat, coarse, and ungainly, but those of the western tribes are slight and graceful. A few are still pagans, but the majority have long been Mohammedans; in the north a considerable number (Sidamas) belong to the Monophysite Church of Abyssinia. The total number of Gallas is estimated by Krapf at from six to eight millions.

Gallas, MATTHIAS, COUNT (1584–1647), Austrian general in the Thirty Years' War, was born in Trent in Tyrol. He served successively with the Spanish in Savoy (1617), under Tilly against Christian IV. of Denmark (1625), and in Italy (1629), when he laid waste Mantua. When Wallenstein was denounced to the emperor, Gallas was appointed to command the army in his place. At Nördlingen (1634) he inflicted a crushing defeat on Duke Bernhard of Saxe-Weimar, and restored to the emperor a preponderating influence in Germany. In 1637 he drove the Swedes under Banér back to Pomerania, but in 1634 he unsuccessfully opposed Torstensson.

Gal'latin, town, Tennessee, county seat of Sumner county, on the Louisville and Nashville Railroad; 26 miles northeast of Nashville. Sumner Training College for boys and Howard Female College are situated here, and there is an interesting Confederate monument in Trousdale Place Park. The city is located in an agricultural district producing corn, wheat, hay, oats, broom-corn, and tobacco, and has flour and lumber mills and tobacco and ice factories. Phosphate rock is mined in the vicinity. Gallatin was settled in 1801. During the Civil War a battle was fought here between the Federals under General Johnson and the Confederates under Gen. John H. Morgan. Pop. (1910) 2,399, (1920) 2,757.

Gallatin, ALBERT (1761–1849), eminent American statesman and financier, was born in Geneva, Switzerland, on Jan. 29, 1761. He was a member of an aristocratic and influential Swiss family, and had every prospect of advancement at home; but his father died when he was four and his mother when he was nine,

and, although he was well cared for and well educated by relatives—he was graduated from the Geneva Academy in 1779—he seems, in the absence of immediate home ties, to have felt a restless desire to break away from his environment, and in 1780, with an intimate friend, Henri Serre, he emigrated to the United States. A trading venture, which proved unsuccessful, took them for about a year from Massachusetts, where they had landed, to Maine; Gallatin then taught French in Boston and in Harvard College (1781–2), and later bought a large tract of land lying between the Kanawha and Monongahela Rivers and settled in Fayette county, Pennsylvania. Shortly after this, he removed to Richmond, Va., engaged successfully in land speculations for several years, and then returned to Pennsylvania. There he entered politics (1787) as an anti-Federalist; in 1789–90 he was a member of the State constitutional convention, and in 1790–2 he was a member of the lower house of the State legislature. In 1793 he was elected by the votes of both Republicans and Federalists to the U. S. Senate. He had served for only three months, however, when through the efforts of the Federalists, who were opposed to him on account of the part he had taken in the agitation in Western Pennsylvania against the Federal excise on whiskey, his election was declared void by a strict party vote. The ground on which the action was based was a technicality in the interpretation of the Constitution, which required a senator, at the time of his election, to have been for nine years a citizen of the United States; Gallatin had been a resident since 1780, but had not taken the oath of allegiance under the Confederation until 1785.

After leaving the Senate, Gallatin was again conspicuous in agitation against the whiskey tax, though he was relatively conservative and exerted himself to prevent violence and bloodshed. (See WHISKEY INSURRECTION.) From 1795 to 1801 he was a member of the Federal House of Representatives, in which his abilities gave him immediate prominence, and during the latter part of the period he was the recognized leader of the Republicans. He was from 1801 to 1814 Secretary of the Treasury in the cabinets of Presidents Jefferson and Madison, and his services during the trying period of the War of 1812 placed him in the foremost rank of America's public financiers. When Russia offered her mediation to the United States and Great Britain, Gallatin went to Russia (May 1813) as a special commissioner (though he retained his portfolio until February, 1814). When Russian mediation failed, he became one of the American peace commissioners who, with the commissioners of Great Britain, negotiated the treaty of Ghent, closing the war (see GHENT TREATY OF). He then assisted in negotiating a special commercial convention with Great Britain in 1815, and from 1816 to 1823 was U. S. minister to France.

Gallatin returned to the United States at a time of considerable political unrest, preliminary to the stirring presidential campaign of 1824. He was nominated for the vice presidency on the ticket with Crawford, but his eligibility to the office was called in question on the ground that he was not a citizen of the United States at the time of the adoption of the Constitution, and in order not to hamper the ticket he withdrew from the canvass in October. In 1826–7 he was U. S. minister to Great Britain, and on his return he settled in New York, where from 1829 to 1839 he was president of the National Bank of New York.

Gallatin spent much of his later life in reading and study, showing an especial interest in American ethnology, of which science he has been called the founder. He published in 1836 a *Synopsis of the Indian Tribes within the United States East of the Rocky Mountains and in the British and Russian Possessions in North America*, which still remains a valuable work, particularly to the student of Indian linguistics, and in 1842 he was instrumental in founding the American Ethnological Society. He continued throughout his life to take an active interest in politics, and his strong anti-slavery views led him to oppose the annexation of Texas and the Mexican War. He died at Astoria, Long Island, on Aug. 12, 1849.

Consult *The Writings of Albert Gallatin*, edited by Henry Adams (3 vols. 1879); Adams' *The Life of Albert Gallatin;* Stevens' *Albert Gallatin* in the 'American Statesmen Series.'

Gallaudet, gal-ô-det', EDWARD MINER (1837–1917), American educator of deaf-mutes, son of T. H. Gallaudet (q.v.), was born in Hartford, Conn., and studied at Trinity. In 1856 he began work as an instructor in the American Asylum for the Deaf at Hartford, and in the following year, with his mother, herself a deaf-mute, who had been one of his father's pupils, established the Columbian Institution for the Deaf at Washington, D. C. Seven years later he helped to organize the National Deaf-Mute College in the same city and becoming its president, continued to fill that position until 1910. In 1886, by request, he presented before the royal commission in England an account of American methods of education of the deaf, dumb, and blind. He published *A Popular Manual of International Law* (1879), and a *Life of Thomas Hopkins Gallaudet* (1888).

Gallaudet, THOMAS (1822–1902), American clergyman and teacher of deaf-mutes, son of T. H. Gallaudet (q.v.), was born in Hartford, Conn., and was graduated (1842) from Trinity College. From 1843 to 1858 he was an instructor in the New York Institution for Deaf-Mutes. Having been ordained a priest of the Protestant - Episcopal Church (1851), he established, in New York, St. Ann's Episcopal Church (1852) for deaf-mutes. He became manager of the newly founded Church Mission to Deaf-Mutes in 1872, and in 1885 founded the Gallaudet Home for Deaf-Mutes near Poughkeepsie, N. Y., meanwhile giving his service to movements in behalf of the deaf in all parts of the country. He published many reports on his work, and wrote numerous articles on the training of the deaf, and allied subjects.

Gallaudet, THOMAS HOPKINS (1787–1851), American teacher of deaf-mutes, was born in Philadelphia, and was graduated (1805) from Yale. He studied divinity at Andover, and was licensed to preach in 1814; but being selected as an investigator by those concerned in the establishment of the Connecticut Asylum for the Deaf at Hartford, he went to Europe (1815) to study the art of instructing the deaf. This he investigated at Paris with the Abbé Sicard, De l'Epée's successor, and with some of the London experts. Returning to America in 1816, accompanied by Laurence Clerc, an educated deaf-mute, he opened at Hartford (April, 1817) the school which in a few years developed into the American Asylum for the Deaf. Of this institution he was principal until 1830. He published a volume of sermons and several books for children. His sons Thomas and Edward (qq.v.) were both active in work on behalf of the deaf. Consult *Life* by E. M. Gallaudet.

Gallaudet College, an institution for the higher education of deaf-mutes, in Washington, D.C.,

inaugurated in 1865 as the National Deaf-Mute College, and renamed Gallaudet College in 1894, in honor of Thomas H. Gallaudet (q.v.). The first president was Edward M. Gallaudet (q.v.), who held office until 1910. The college was opened to women in 1887, and in 1891 a normal department was established. The curriculum of five years includes a preparatory year. The degrees of B.A. and B.S. are conferred, and 125 students from the different States are admitted free of charge. For latest statistics see Table of Universities and Colleges under the heading COLLEGE.

Gall-bladder, a membranous sac for the temporary storage of bile, situated in a depression on the under side of the liver. It is approximately pear-shaped, about 4 in. long and an inch in breadth at its widest part. It is connected by the cystic duct with the hepatic duct, the two forming the common bile duct which empties into the intestinal tract. Infection of the gall-bladder is known as cholecystitis. It may occur in conjunction with the acute infectious diseases, especially typhoid fever, or may result from gall-stones or obstruction of the cystic or common gall duct. The most common affection of the gall-bladder is cholelithiasis, or gall-stones (q.v.). See also LIVER.

Galle, gäl (formerly POINT DE GALLE), seaport, Ceylon, on the southwestern coast; 66 miles southeast of Colombo. It was for long the chief port of the island, but since the transference of the shipping traffic to Colombo, trade has much declined. The harbor is small and difficult of entrance in rough weather. Features of interest are All Saints' Church, a handsome stone building, a quaint old Dutch church built in 1752, and the fine old Dutch fort in excellent preservation. The environs are interesting and picturesque. Pop. (1931) 38,424.

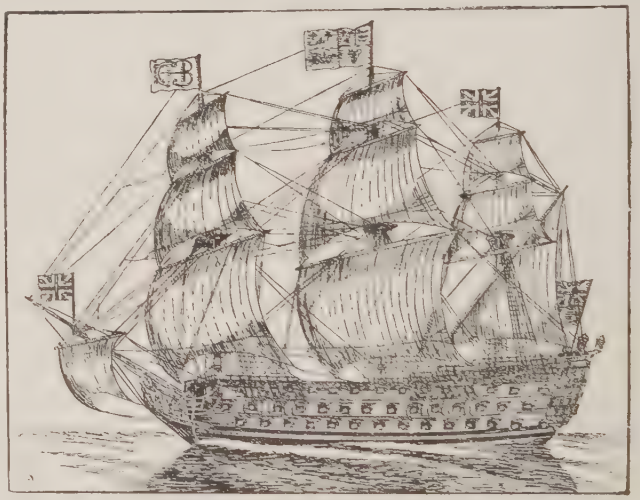
Galle, gäl'e, JOHANN GOTTFRIED (1812-1910), German astronomer, was born near Wittenburg. He was appointed to a post at the Berlin observatory in 1835, and in 1851 became professor of astronomy and director of the observatory at Breslau. His observations included the actual discovery (Sept. 23, 1846) of the planet Neptune, whose existence had been asserted by Leverrier, and of three comets. He contributed, also, to meteorological research. In 1857 he published *Grundzüge der schlesischen Klimatologie;* in 1879, *Mitteilungen der Breslauer Sternwarte;* in 1849, *Verseichniss der Elemente der bisher berechneten Kometenbahnen.*

Gallego, gäl-yā'gō, the Spanish name for the cold piercing north and northwest wind that blows from Galicia. The name is also applied to the natives of Galicia.

Gallenga, gäl-leng'gä, ANTONIO CARLO NAPOLEONE (1810-95), Italian historian and publicist, whose earlier works appeared under the pseudonym Luigi Mariotti, was born in Parma. He was graduated from the University of Parma and, for his participation in the revolutionary struggle of 1830, was imprisoned for a short time but escaped to France and later visited the United States and Spain. He returned to Italy in 1833, became involved in the intrigues of Mazzini, and was commissioned by him to assassinate Charles Albert, King of Piedmont, which deed, however, he failed to perform. After living for a time in Corsica, Tangiers, and Cambridge, Mass., he went to London and there engaged in literary work, becoming professor of Italian literature in University College in 1843. Three years later he became a British subject. Returning to Italy in 1848, he was *charge d'affairs* for Piedmont at Frankfort and deputy in the Piedmontese Parliament (1854–64). He was correspondent of the London *Times* from 1859 to 1883, serving in Austria, the United States, Spain, Cuba., and Constantinople. Among his published works, written in English, of which he was a master, are *History of Piedmont* (1855); *Country Life in Piedmont* (1858); *Italy Revisited* (1875); *The Pope and the King* (1879); *Italy, Present and Future* (1887).

Galleon, gal'i-un, a name formerly given to Spanish ships of war with three or four batteries of cannon, and later applied to the large Spanish merchant ships, usually with four decks. Two fleets sailed every year from Spain—one to Mexico, and the other to Peru. The former were called 'the flota,' and the latter 'the galleons.'

Gal'lery, an architectural term originally used of long corridors connecting two portions of a building. As these were often adorned with pictures, the term came to be applied to any room in which pictures were hung, as the Uffizi and Pitti Galleries in Florence and the Louvre in Paris. In Gothic architecture the term gallery denotes the division into stories of the façades of a church, marked by balustrades or arcades. Balconies running around the tops of auditoriums, as in theatres, and on the outside of houses, especially in warmer countries, are also called galleries.

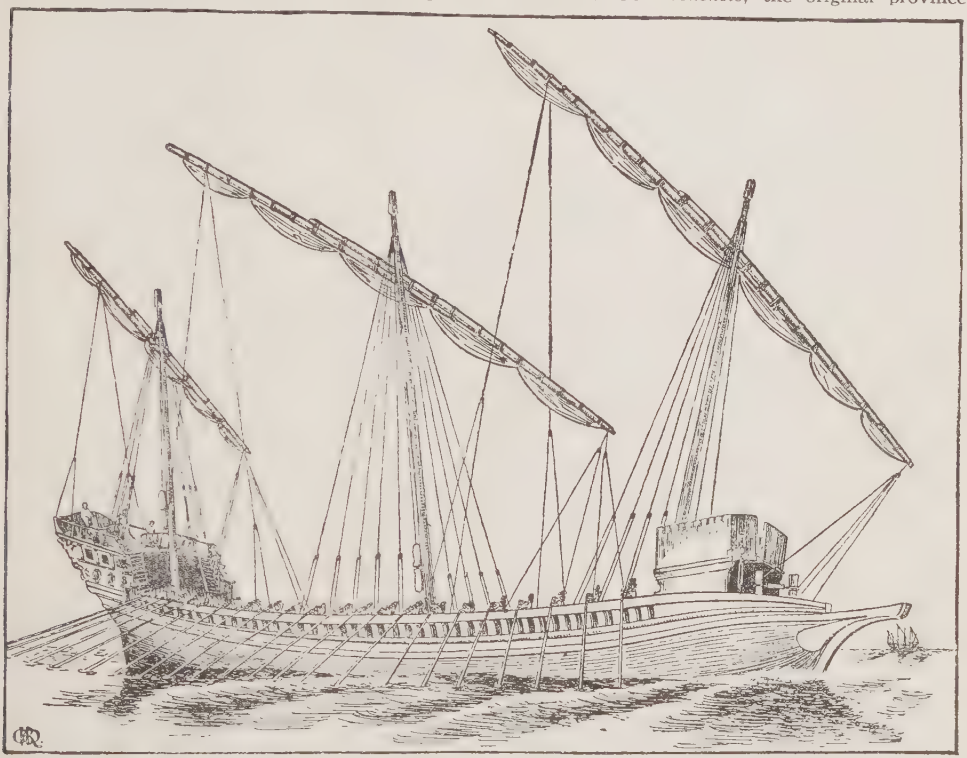


Galleon

Gal'ley, a low, flat vessel equipped with oars and sails, in ancient times the common type of both merchant and war craft. War vessels were provided with spears, javelins, swords, and other weapons, and, in order to attain the greatest possible speed, the number of oars was increased from a single tier to three, as in the trireme (q.v.), or even to five or six.

In the Middle Ages the galley was the war ship of the Mediterranean countries. It was gener-

ally a long, narrow, one-decked vessel carrying several hundred men, lateen-rigged, and propelled by from twenty to thirty oars on a side. The rowers were usually prisoners and felons, six or seven to each oar, and the galleys were heavily armed.



Galley

Gall Flies, a name applied to certain members of the family Cynipidæ, of the order Hymenoptera, to whose activities the galls (q.v.) seen in certain plants are due. Not all members of the family, however, produce galls, and some galls are produced by other agencies (see GALL MIDGES). The action of these insects is illustrated by *Rhodites*

Gall-fly

rosæ, which attacks the wild rose. The minute adult female, in the spring, pierces the leaf-bud and deposits her eggs within it. Here the developing larvæ seem to exercise some particular influence on the growing tissue, so that, instead of stem and leaves, there arises the red, much-branched structure which forms the bedeguar gall. Within this a series of chambers contain both the gall-producing larvæ and guest or parasitic larvæ which feed upon the substance of the gall or upon the tissues of the first inhabitants. In some gall-flies a curious alternation of generations occurs. One generation may include both sexes, while the next consists entirely of females which reproduce parthenogenetically. See GALLS; OAK. Consult Howard's *The Insect Book*.

Gallia, gal'i-*a*, in ancient times, the country inhabited by the Gauls. It embraced two regions —Gallia Cisalpina or Citerior, and Gallia Transalpina or Ulterior. The latter, the real home of the Gauls, included all of modern France and Belgium and parts of Holland, Germany, and Switzerland. The Romans began the conquest of Gaul about 125 B.C., and in 121 the south of Gaul was made into a Roman province known as Provincia (hence the modern Provence). Between 58 and 50 B.C. Julius Cæsar conquered the rest of Gaul, which was then divided into three parts—*Aquitania*, between the Pyrenees and Garonne; *Celtica*, between the Garonne and Seine; and *Belgia*, north of the Seine. Augustus divided Gaul into four provinces—*Narbonensis*, the original province; *Aquitania*, from the Pyrenees to the Loire; *Lugdunensis*, between the Loire, Seine, and Saône; and *Belgica*, between the Seine, Saône, and Rhine.

Gallia Cisalpina was the name given to the north of Italy, between the Apennines and the Alps. It was occupied by Gallic invaders probably in the 5th or 6th century B.C. After the first Punic War the Romans conquered the country and made it a province, though it was not until the defeat of the Boii in 191 that the conquest was secure. Consult Holmes' *Cæsar's Conquest of Gaul*.

Galliard, gal'yerd; *Fr.* gà-yär', a dance tune; also a dance for two persons, common in the 16th and 17th centuries. It is said to have been the forerunner of the minuet.

Gal'lic Acid, one of the six possible trihydroxybenzoic acids, $C_6H_2(OH)_3COOH$, a constituent of gall-nuts, sumach, divi-divi,

etc. It can be prepared by boiling its glucoside, tannin, with dilute acids, and is obtained in the form of white, silky, astringent needles, soluble in water, giving an acid solution which precipitates ferric salts but not gelatin. It is a powerful reducing agent, forms numerous gallates, and when heated to 215° C. yields pyrogallol.

Ancient Gaul

Gal'licanism, an attitude widely prevalent in the Roman Catholic Church of France, especially during the seventeenth and eighteenth centuries, tending toward national independence and more or less indifference to papal authority. In the fourteenth century the conflict between Gallican principles and the papal see became acute under Philip the Fair. A bold stand against the papacy was taken in the Pragmatic Sanction (q.v.) of Bourges in 1438 under Charles VII., and in 1682 the Gallican feeling reached its highest point, when the 'four propositions or declarations of the French clergy,' drawn up by Bossuet (q.v.), were signed at Paris by thirty-five bishops and thirty-five lesser clergy. The propositions were to the effect that (1) kings and princes are not subject to the ecclesiastical power in temporal affairs, and cannot be deposed by it; (2) the Pope's power is limited by the decisions of general ecumenical councils as well as (3) by the canons of the universal church, and the rules, customs, and institutions of the French kingdom and church; (4) the Pope's judgment in matters of faith is not final unless it is supported by the whole church. These declarations were successively condemned, between 1690 and 1800, by Alexander VIII., Clement XI., and Pius VI. After the revolution, Napoleon concluded a concordat with the Pope (1802), but in 1810 he reaffirmed the conditions created by the declarations, and in 1813 Pius VII., was compelled to sign (though he afterwards repudiated it) the Concordat of Fontainebleau, which did not recognize his right to institute bishops. The Vatican Council of 1869 directly condemned three of the four declarations, and since that time Gallicanism has steadily declined. Consult Jervis' *History of the Church of France* and *The Gallican Church in the Revolution.*

Galli-Curci, gäl'lē kûr'chē, Amelita (1889–), Italian coloratura soprano, was born in Milan, Italy. She attended the International Institute and the Lyceum High School in Milan, studied piano at the Royal Conservatory, and upon her graduation in 1908 was appointed professor in that institution. As a vocalist she is self taught. She made her début in Rome in 1909, as Gilda in *Rigoletto,* and later toured Spain and Italy. Her American début was made with the Chicago Opera Association in 1916, in the same rôle with which she had opened her operatic career. Her first appearance with the Metropolitan Opera Company, New York City, took place in 1921 as Violetta in *La Traviata.* She was married in 1910 to the Marquis Luigi Curci, and in 1921 to Homer Samuels, an American. Mme. Galli-Curci is an American citizen.

Gallieni, gal-i-ē'nī, Joseph Simon (1849–1916), French soldier and colonial official, was born in Saint-Béat (dep. Haute-Garonne). He was educated for the army at St. Cyr and after serving in the Franco-German War, and with the French expeditions in the basin of the Upper Niger (1877–81), was stationed for a time in Tonking. In 1896 he became governor-general of the new French colony of Madagascar. He remained there until 1905 and subsequently became military governor of Lyons. In the early days of the Great War Gallieni was appointed military governor of Paris, a position which he held successfully for fourteen months, having a large share in the movement which checked the German advance on the French capital. He became Minister of War in 1915, but was forced by ill health to retire in March, 1916. He died the following May.

Gallienus, gal-i-ē'nus, Publius Licinius Valerianus Equatius, Roman emperor, son of Valerian, was associated with his father in the government in 253 A.D. In 260, when Valerian was captured by the Persians, Gallienus became emperor, and reigned until 268 A.D. During his reign numerous usurpers, known as the Thirty Tyrants, sprang up. While besieging one of these, Aureolus, in Milan, the emperor was murdered by his soldiers.

Galliffet, gä'lē'fā', Gaston Alexandre Auguste de, Marquis de (1830–1909), French general, was born in Paris. He served in the Crimea, Italy, and Mexico; in the Franco-German war made a brilliant cavalry charge at Sedan; won a reputation for harshness in his treatment of the communists; commanded in Algeria (1872); and became minister of war, in June 1899, in the cabinet of Waldeck-Rousseau. From the latter position he resigned in May 1900, after having carried the government safely through the Dreyfus crisis. Consult his *Mes souvenirs.*

Gallina'ceous Birds, or Gallinaceæ, a large order of birds. They have usually a small head, short bill, large crop, and short wings. The feet are adapted for walking and for scratching. The plumage of the males is often brilliant and beautiful. Four sub-orders are included: (1) the curious rail-like Mesites of Madagascar; (2) the Turnices, to which belong the hemipodes, known as bustard-quails or button-quails; (3) the Galli, including the mound-builders and brush-turkeys, the curassows and guans, the guinea-fowls, turkeys, pheasants, partridges, and grouse; (4) the Opisthocomi, comprising

only the curious hoatzin (q.v.) of South America.

Gallinago. See SNIPE.

Gallinger, gal'in-jer, JACOB H. (1837–1918), American public official, was born in Cornwall, Ontario, of American ancestors. After a common-school education, he became a printer, but in 1858 was graduated from the medical department of Dartmouth College and established a successful practice in Concord, N. H. In 1872 (and again in 1891) he was elected a member of the New Hampshire House of Representatives; in 1876 was a member of the Constitutional Convention; and in 1878, 1879, and 1880 was elected to the State Senate. He was a delegate to the National Republican conventions of 1886, 1900, 1904, and 1908, and was elected to Congress in 1885 and 1887. In 1891 he was elected to the United States Senate, being re-elected in 1897, 1903, 1909, and 1915.

Gal'linule, a water-bird allied to the rails and coots, several species of which inhabit marshes in North and South America and in the Old World. They are known everywhere as 'water hens' and 'mud hens,' and are usually shot for sport, although the flesh is edible. They are handsome birds with brown or olive plumage, marked with purple or chestnut. They swim and dive well, feeding upon vegetable matters as well as snails and crustaceans. The nest is usually made on the ground near the water, and several heavily spotted eggs are laid. The most widespread of the American species is the Florida Gallinule (*Gallinula galeata*).

Gallio, gal'i-ō, the proconsul of Achaia, 53-54 A.D., mentioned in Acts xviii. 12–17. He was a brother of Seneca and uncle of Lucan, and ultimately fell a victim (by compulsory suicide) to the savagery of Nero. His name has become a synonym for easy-going indifference.

Galliot, gal'i-ot, a Dutch vessel generally used for fishing, carrying a mainmast and a mizzen-mast, and a large gaff-mainsail also a small galley, a kind of brigantine, built for pursuit, and propelled by both sails and oars.

Gallipoli, gäl-lē'pō-lē, peninsula and seaport, European Turkey, in the vilayet of Adrianople. The peninsula consists of a narrow tongue of land, some fifty miles long and varying in width from two or three to twelve miles, separating the Dardanelles from the Gulf of Xeros. It consists of a mass of steep, rocky ridges rising more than 700 feet from the sea, and covered for the most part with a dense growth of scrub. On the east coast, at the head of the Dardanelles, is the town of Gallipoli. It is the see of a bishop of the Greek Church, and has interesting mediæval ruins, notably a Genoese tower in the market place. Pop. (1921) 38,015.

In 1294 the Genoese won a victory over the Venetians at Gallipoli, and in 1416 the Venetians defeated the Turks here. In the Great War the peninsula was the scene of the disastrous Dardanelles campaign (see DARDANELLES; EUROPE, GREAT WAR OF).

Gallipoli, town, Italy, in the province of Lecce, on the Gulf of Taranto; 30 miles southwest of Lecce. The old town is situated on an island connected by a bridge with the modern town on the mainland. Near the bridge are the cathedral and the castle. The town is a centre for the manufacture of casks and the export of oil and wine. It was sacked by the Venetians in 1484. Pop. (1921) 8,036.

Gallipolis, gal'li-pō-lēs', city, Ohio, county seat of Gallia county, on the Ohio River, and on the Hocking Valley and the New York Central Railroads; 95 miles southeast of Columbus. It is the seat of Gallia Academy and of the Ohio Hospital for Epileptics. Machinery, furniture, leather, bricks, iron castings, and brooms are manufactured. Gallipolis was settled by the French in 1790, the name signifying 'city of the Gauls.' Pop. (1910) 5,560; (1920) 6,070.

Gallipoli, Strait of. See DARDANELLES.

Gallitz'in, borough, Pennsylvania, Cambria county, on the Clearfield River, and on the Pennsylvania Railroad; 75 miles east of Pittsburgh. Coal mining and coke production are the chief industries. The borough, incorporated in 1872, was named for Prince Gallitzin (q.v.). Pop. (1910) 3,504; (1920) 3,580.

Gallitzin, gä-lēt'sēn, DEMETRIUS AUGUSTIN, PRINCE (1770-1841), Russo-American clergyman, was born in The Hague, Holland, where his father was Russian ambassador. He became a Roman Catholic in 1787, and in 1792 was sent by his parents to America, where he entered the priesthood (1795) and for several years worked under the name of Father Smith. He was in charge of various missions in Maryland and Pennsylvania until 1800, when he secured a large tract of land at Loretto, Pa., and there established a Roman Catholic church and colony, which became the parent of colonies in other parts of Pennsylvania. He lost his Russian inheritance through entering the priesthood, but until 1817 received contributions from his family, which he devoted to his religious work. Father Gallitzin was a prominent factor in the early development of the Catholic Church in the United States. He was appointed vicar-general of the diocese of Philadelphia in 1809, but subsequently resigned this office. He wrote much on controversial subjects.

Gal'lium (Ga, 70.1), a rare metal, discovered spectroscopically in 1875 by Lecoq de Boisbaudran, in the zinc blende of Pierrefitte, Hautes-Pyrénées. It is a hard, grayish-white metal, of specific gravity 5.9, melting at 30.1° C., and remaining liquid at lower temperatures, unless touched by a crystal of the metal. It is the only metallic element, besides mercury, which can be liquid at ordinary temperatures. Gallium belongs to the aluminium group, is the eka-aluminium predicted by Mendeléeff, and forms two series of compounds in which it appears as divalent and trivalent.

Gall Midges, or GALL GNATS, minute flies belonging to the order Cecidomyiidæ. They feed upon plant tissues, most of them producing galls (q.v.). The species of greatest economic importance is the Hessian fly (q.v.), which in the larval state lives in the stems of wheat, doing great damage to the crop. Zoologically the gall midges are important because two European species are capable of reproduction while still in the larval form, this precocious reproduction taking place apparently by a kind of internal budding known as pædogenesis. See GALLS; GALL FLIES.

Gal'lon, a measure of capacity containing four quarts. The U. S. gallon is defined as a volume of 231 cubic inches. It is equivalent to the volume of 8.32162 lbs. avoirdupois of distilled water when weighed in air of 50 per cent. humidity and 760 mm. pressure at 68°F. (20° C.) against brass weights. (At 62° F. the weight of a U. S. gallon of water under the above conditions is 8.32675 lbs.). The British imperial gallon is defined as the volume of 10 imperial lbs. of distilled water as weighed in air against brass weights, with both the water and the air at a temperature of 62° F. and the barometer at 30 inches. It is equivalent to a volume of 277.42 cubic inches.

Galloway, gal'ō-wā, ancient district, in the southwest of Scotland, now comprising the shires of Kirkcudbright and Wigtown.

Galloway, MULL OF, a rocky promontory in Wigtownshire, Scotland, forming the southern extremity of the peninsula known

as the Rhinns of Galloway. It is a mile and a quarter long and a quarter of a mile broad, with almost perpendicular sides. It contains many caves accessible only from the sea. Remains of Scandinavian defences and the chapel of St. Medan, in the construction of which a natural cave was used, are of interest.

Galloway, Beverly Thomas (1863–), American botanist, was born in Millersburg, Mo. He was graduated from the University of Missouri in 1884, and for two years was assistant there in the horticultural department. In 1887 he became assistant in the section of mycology of the U. S. Department of Agriculture, and in 1888 was made chief of the section. From 1888 to 1900 he was chief of the Division of Plant Pathology, and from 1901 to 1913 chief of the Bureau of Plant Industry. In 1913–14 he served as Assistant Secretary of Agriculture, and in 1914–16 was dean of the New York State College of Agriculture, Cornell University. In 1916–33 he was pathologist in the Office of Foreign Plant Introduction of the U. S. Dept. of Agriculture, and later collaborator.

Galloway, Joseph (1731–1803), American lawyer and loyalist, was born in Kent county, Maryland, and began his career as a lawyer in Philadelphia, where he became an intimate friend of Franklin. From 1757 to 1774 he was a member of the Pennsylvania Assembly, and, with Franklin, opposed John Dickinson, the zealous advocate of the proprietary government. In the colonial struggle his sympathies were with the English monarchy, and as a member of the Continental Congress he exerted himself in behalf of modifying opposition to the crown. He signed the Articles of Association in favor of the 'non-importation, non-consumption, and non-exportation' of articles between Great Britain and her colonies, and proposed a plan of government known as the 'Plan of a Proposed Union.' This plan, which provided that the colonies were to be governed by a president-general, appointed by the king and holding office during his pleasure, and a grand council chosen every three years by the colonial legislatures to act with the British Parliament, was rejected by a majority of only one of the colonies. Although urged by Franklin to cast his lot with the advocates of independence, Galloway joined General Howe, and aided him in his march to Philadelphia with advice and information. After the capture of that city, he was made superintendent of the port and of the police. After its evacuation he retired to England and the Pennsylvania Assembly confiscated for high treason his estates, the value of which he estimated at £40,000. Notwithstanding Howe's previous friendship for him, Galloway appeared before Parliament as an accusatory witness of the general's incompetency and failure in his New Jersey campaigns. Among his publications are: *A Candid Examination of the Mutual Claims of Great Britain and the Colonies* (1775); *Letters to a Nobleman on the Conduct of the War in the Middle Colonies* (1779); *Cool Thoughts on the Consequences to Great Britain of American Independence* (1780); *The Claim of American Loyalists Reviewed and Maintained upon Incontrovertible Principles of Law and Justice* (1788).

Galloway, Lord of. See Douglas.

Galls, abnormally altered, usually hypertrophied plant tissue-bodies, due commonly to the activity either of insects or parasitic fungi. The galls produced by insects are of many kinds. Felted growths of definitely limited extent, such as occur in the

Gall

lime, horse-chestnut, bramble, and walnut, are known as 'felt galls'; those which take the form of a hollow structure created by the hypertrophy of the tissue around the spot occupied by the insect are known as 'rantle galls' —examples being afforded by the buckthorn and the alpine rose; those in which an insect pierces the plant and deposits its eggs in the substance, and not on the surface, thus causing the tissue to hypertrophy in such a way that the wound occupies the center of the resulting sphere, are known as 'solid or tuberculous galls'—*e.g.* oak-apples and the bedeguars of the wild rose. Galls produced by parasitic fungi are usually caused by the excreta of the plant; common examples of such galls are the tumors and wens found on the leaves and stems of organisms infested by parasites. Some galls, as those of the oak, are rich in tannin. See Gall Flies; Gall Midges; Oak.

Gall Stones, or Biliary Calculi, pathological concretions derived from the bile, giving rise to the condition known as cholelithiasis. They are almost invariably formed in the gallbladder, although in a few cases they appear to originate in the biliary ducts. They may be single, in which case they often attain a large size, instances being recorded of calculi measuring over five inches in length. On the other hand, they may be small and numerous, many hundreds being sometimes contained in a distended gallbladder; in some cases they occur in the form of a gritty sand. On section, a calculus exhibits a nucleus, which generally consists of mucus and epithelial detritus, but the greater portion of the stone is composed of cholesterin, with varying quantities of bile acids, pigment, and various salts. A calculus often displays concentric lamination, the outer layers being the more recent.

Gall stones are much more common in women than in men and in 75 per cent of cases occur after the age of forty. Sedentary occupations, especially when associated with over-indulgence in food, contribute to the condition, while infections, notably typhoid fever, and pregnancy are important factors.

Symptoms.—Gall stones may remain within the gallbladder for many years without producing symptoms or they may give rise to various digestive disturbances of greater or less degree. When, however, the calculi become impacted in the cystic or in the common bile duct, acute symptoms of biliary colic generally supervene. The onset is usually sudden, and is characterized by agonizing pain in the right hypochondriac region, along with vomiting, as well as rigors, rise of temperature, and, it may be, collapse. The pain radiates towards the shoulder, in marked contrast to that of renal colic, which shoots downwards. When the stone is impacted in the common bile duct, for some length of time, jaundice develops. The duration of an attack varies from a few hours to several days; relief may be due to the fact that the calculus has dropped back into the gallbladder, or has escaped into the duodenum. Chronic obstruction of the cystic duct by gall stones usually results in great distension of the gallbladder. Suppuration, with the formation of abscesses, may supervene, and in some cases perforation has led to fatal peritonitis.

Treatment.—During an attack of acute biliary colic the pain is frequently so intense that immediate relief is demanded.

Hypodermic injections of morphine and atropine usually suffice, though these must sometimes be supplemented by a general anæsthetic. Hot fomentations applied to the abdomen may give relief. The patient should receive laxatives, and large quantities of alkaline waters. Between the attacks exercise should be enjoined, and the diet must be regulated so as to exclude as far as possible fats and starches. The certain presence of stones within the gallbladder or biliary ducts would seem to be sufficient indication for operation unless this is contra-indicated by associated conditions. Medical measures directed toward solution of the stones or toward facilitating their escape are apparently valueless.

Gal'lup, town, New Mexico, county seat of McKinley county, on the Atchison, Topeka and Santa Fe Railroad; 144 miles N.W. of Albuquerque. Coal is mined in the vicinity, and there are productive oil wells and extensive deposits of fire-clay. The city is the chief market for Navajo rugs, jewelry and blankets. The municipal water system includes wells, 1,141 to 2,000 feet in depth, supplying an abundant flow. The largest Indian Ceremonial Dance and Craft exhibit in the world is held here every August. Pop. (1920) 3,920: (1930) 5,992.

Gallus, gal'us, CAIUS CORNELIUS (c. 70–26 B.C.), Roman poet and statesman under Augustus. At Actium, in 31 B.C., he commanded a detachment in the army of Octavian, and afterwards gained successes over Antony's forces off the African coast, and captured Cleopatra. After her death, Gallus ruled Egypt for some years, but incurred the hostility of Augustus, and was exiled by the senate, whereupon he committed suicide. He was the friend of Virgil and Ovid. None of his writings remains.

Gallus, CAIUS VIBIUS TREBONIANUS, Roman emperor (251–253 or 254 A.D.), is said to have contributed by his treachery to the defeat in which the emperors Decius and Herennius fell. He was then made emperor by the soldiers in November, 251, and concluded a disgraceful peace with the Goths. Gallus and his son were slain by their own troops.

Galluzzo, gal-lo͞ot'sō, town, in the province of Florence, Italy, 3 miles southwest of Florence, of which it is virtually a suburb.

Gall'witz, MAX C. W. VON (1852–1937), German general, was born in Breslau. He was educated at the military academy and in 1870 entered the artillery service, passing through the various grades until in 1896 he became lieutenant-colonel, and in 1902 major-general. He became inspector of field artillery in 1911 and was artillery war commander during the World War. He was one of von Mackensen's commanders in 1915, was in command in Serbia and on the Cambrai front, and in 1918 headed the army group in the Verdun sector. He retired from active service at the end of 1918. From 1920 to 1924 he was a member of the Reichstag.

Gal'ly, MERRITT (1838–1916), American inventor, was born in Perry, N. Y. He was educated at Rochester University and at Auburn Theological Seminary and was for some years a Presbyterian clergyman, but was forced by throat trouble to retire from the ministry. Among his most important inventions are the Universal job printing press, a linotype machine, a multiple telegraph system, a machine for constructing types from cold metal by a process of swaging, and mechanism for relays and repeaters in telephones and musical instruments.

Galois, gà-lwä', EVARISTE (1811–32), French mathematician, was born in Bourg-la-Reine, near Paris, and was educated in the college of Louis-le-Grand and at the Ecole Normale. When little more than twenty years of age, he was killed in a duel in Paris, but not before he had given abundant evidence of an extraordinary mathematical genius. He published several papers and memoirs on the theory of equations and the theory of numbers. At the time these attracted little attention because of their lack of conciseness and clearness, but the fundamental ideas later elucidated profoundly influenced mathematical philosophy. Galois is the originator of the theory of groups.

Galop, gàl-ō (Fr.), a spirited dance probably of German origin, in two-four time; also the music for the same. It became fashionable in Parisian society about 1830, and thence passed to England and the United States.

Gals'worthy, JOHN (1867–1933), British novelist and dramatist, was born in Coombe, Surrey. He was educated at Harrow and Oxford, studied law, and in 1890 was called to the bar, but devoted himself almost entirely to literary work. His earliest novel, *Jocelyn,* was published in 1898, and was followed in 1900 by *Villa Rubein.* Neither of these works attracted particular attention, but with the publication of *The Island Pharisees,* in 1904, the author's reputation was assured. His novels include: *The Man of Property* (1906); *The Country House* (1907); *Fraternity* (1908); *The Patrician* (1911); *The Dark Flower* (1913); *The Freelands* (1915); *Saint's Progress* (1919); *In Chancery* (1920); *To Let* (1921); *The Forsyte Saga* (1922); *The White Monkey* (1924); *The Silver Spoon* (1926); *Caravan; Swan Song* (1928); *A Modern Comedy* (1929); *On Forsyte 'Change* (1930); *Maid In Waiting* (1931); *Flowering Wilderness* (1932). His plays include *The Silver Box* (1909); *Joy* (1907); *Justice* (1910); *The Mob* (1914); *Loyalties* (1922); *The Show* (1925); *Exiled* (1929); *The Roof* (1929). In 1932 he won the Nobel Prize for Literature. See H. V. Marrot, *Life and Letters of John Galsworthy* (1936).

Galt, city, Waterloo county, Ontario, Canada, on the Canadian National and the Canadian Pacific Railroads; 60 miles S.W. of Toronto. The city is built on both sides of the river, which is crossed here by three bridges. It is the seat of a collegiate institute, and has splendid parks and recreation grounds. Water power is abundant, and there are manufactures of boilers, boots, brass goods, builders' supplies, farm implements, leather, lumber, pumps, soap and oils, silk yarns, rubber and heating goods, hats, knitted goods and metal goods. Pop. (1931) 14,000.

Galt, SIR ALEXANDER TILLOCH (1817–93), Canadian statesman, was born in Chelsea, London, son of John Galt (q. v.), the novelist. In 1835 he emigrated to Canada, and in 1849 entered the Canadian Parliament; he resigned after a brief term but again sat from 1853 to 1872. He was the first finance minister of the Dominion (1867), and its high commissioner to England (1880–3). He also served on a number of commissions, notably the Halifax Fisheries (1877) and the Washington Treaty (1870). He was president of the Guarantee Company of North America.

Galt, JOHN (1779–1839), Scottish novelist, was born in Irvine, Ayrshire, educated in Greenock, and in 1806 settled in London. He spent the years 1826–29 in Canada as secretary of the Canada Company. His first really successful work, *The Ayshire Legatees,* appeared in 1820, and was followed in 1821 by his masterpiece, *The Annals of the Parish.* In 1833 appeared his *Autobiography,* and in 1834 his *Literary Life and Miscellanies.* His best novels, besides those mentioned above, are *The Entail* (1824), *The Provost* (1822), *Sir Andrew Wylie* (1822), and *Lawrie Todd*

(1830), this last containing vivid sketches of frontier life in the United States. In depicting the life of small Scottish towns and villages he is unsurpassed, even by Scott. An edition of his *Novels* appeared in 8 vols.

Galt, Sir Thomas (1815–1901), Canadian jurist, son of John Galt (q. v.), the novelist, was born in London, England, was educated in Scotland, and as a youth removed with his father to Canada. He subsequently lived three years in Great Britain, but returned to Canada, and for six years was associated with the Canadian Land Co. at Toronto. At the age of thirty he was admitted to the Canadian bar, and speedily attained eminence. He became Queen's counsel in 1858 and chief justice of the Court of Common Pleas in 1887. He was knighted in 1888.

Gal'ton, Sir Douglas Strutt (1822–99), British scientist, was born near Birmingham. He was appointed secretary to the Railway Commission in 1847, and in 1854 visited the United States to inspect railways, having become secretary to the Railway Department of the Board of Trade. After serving in various other public offices, including the directorship of public works (1869–75), he devoted himself to sanitary science and electrical engineering, upon which he wrote extensively. He was president of the British Association (1895).

Galton, Sir Frances (1822–1911), British anthropologist, cousin of Charles Darwin, was born in Birmingham. He was educated at King's College, London, and at Trinity College, Cambridge, and after the death of his father in 1844 made a journey up the Nile to Khartum and went on an expedition of exploration to Damaraland, Southwest Africa (1850–52). On his return he published an interesting account of his travels and discoveries entitled *Tropical South Africa,* followed by *The Art of Travel.* In 1863 appeared his *Meteorographica, or Methods of Mapping the Weather,* the basis of the system of weather forecasting now in general operation, and in 1869 *Hereditary Genius,* the result of the researches into the laws of heredity with which his name is chiefly associated. In 1884–5 he initiated an anthropometric laboratory in connection with the International Health Exhibition in London, including among the data collected impressions of finger prints, a means of identification now used in almost all criminal investigations. He also devised the method of composite photographs, made important contributions to psychology, and founded the science of eugenics.

Galton received many honors and medals for his scientific work; he was secretary of the British Association in 1863–7 and twice declined its presidency; was editor of *Biometrika,* and in 1909 was knighted. Besides the works already mentioned, he published *English Men of Science* (1874); *Inquiries into Human Faculty.* (1883); *Natural Inheritance* (1889); *Finger Prints* (1893); *Finger Print Directory* (1895); *Memoirs of My Life* (1908).

Galtonia, gôl-tō'ni-*a,* a genus of South African, hardy, liliaceous plants, of which the sweet-scented, white-flowered *G. candicans,* the summer hyacinth, is most familiar in gardens. This bears its drooping flowers in a long raceme at the summit of a scape upward of four feet in height. Galtonias grow best in a light soil containing leaf-mold and peat.

Gal'va, city, Illinois, Henry county, on the Chicago, Burlington and Quincy, and the Chicago, Rock Island and Pacific Railroads; 139 miles s.w. of Chicago. It is the shipping center of a corn-growing district and has manufactures of creamery butter, display racks and fixtures for floor coverings, casket hardware, electrical conduit fixtures, road graders and drags, and steam and hot water heaters. The artesian-water system is owned and operated by the municipality. Electricity is furnished from Keokuk. Pop. (1920) 2,974; (1930) 2,875.

Galvani, gäl-vä'nē, Luigi (1737–98), Italian physiologist and anatomist, from whose name the word galvanism is derived, was born in Bologna. He studied medicine under the distinguished physician Galeazzi, whose daughter he married, and in 1762 became professor of anatomy in the University of Bologna. It was purely by accident, so it is said, that he discovered the phenomenon of galvanic activity. His wife, having noted the convulsive twitching produced in the leg of a skinned frog following contact of the crural nerve with the point of a scalpel charged with electricity, called the fact to his attention. Galvani thereupon instituted a long series of experiments, as a result of which he published in 1791 his treatise *De Viribus Electricitatis in Motu Musculari.* Refusing at the revolution to take the oath of allegiance to the Cisalpine republic, he was deprived of his professorship, but was reinstated shortly before his death. His collected works appeared at Bologna in 1842.

Galvaniz'ing, the process of coating iron and steel products with zinc to prevent rusting. The oldest galvanizing process and the one most generally used is the hot or dipping process. The iron is first carefully cleaned by pickling with acid and scouring with sand. It is then dipped in a bath of molten zinc covered with a sal ammoniac flux to prevent adhesion. Cold or electro-galvanizing is a process of zincking by electro-deposition from a bath containing salts of zinc and alumina. It is suitable for springs, wire netting, screws, bolts, nuts, and machine parts having threads and perforations.

Galvanized tinware, so-called, is merely galvanized ironware which has received a thin deposit of tin before the zinc has been applied. In this way a particularly uniform coating of zinc is obtained. Consult W. F. Flanders, *Galvanizing and Tinning* (1922); H. Bablik, *Galvanizing* (2nd ed., 1936); H. S. Rawdon, *Protective Metallic Coatings* (1928).

Galvanocautery. See Cautery, Electricity in Medicine and Surgery.

Galvanometers, a class of sensitive electrical measuring instruments used to detect or compare electrical quantities. The most commonly used type is the d'Arsonval Galvanometer shown in Fig. 1. A U-shaped permanent magnet has a cylinder of soft iron centrally located between the jaws of the U. A rectangular coil of fine wire is suspended to swing freely in the two gaps between the cylinder of soft iron and the magnet. The suspensions may be gold and often are less than 0.001 inches thick. The coil carries a mirror which reflects a beam of light on a scale to indicate the position of the coil. When a direct current passes through the coil there is a reaction on the permanent magnet field which produces a torque

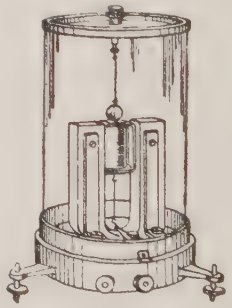


Fig. 1.—*D'Arsonval Galvanometer*

on the coil. The moving element will turn until the torque of the suspension is equal to the electrically produced torque.

A galvanometer of this type is used in Wheatstone Bridge circuits for the measurement of resistance. In this use and in many similar applications the measuring technique consists of adjusting circuit elements until there is no deflection of the galvanometer. Since in such uses there is no deflection when the final adjustment is made, the calibration of the galvanometer is immaterial.

A very sensitive galvanometer may change in sensitivity due to external influences such as temperature changes or stray fields produced by current-carrying conductors in the vicinity. When such a galvanometer is used to measure a current accurately, it is customary to calibrate it before and after making a measurement. This procedure in effect compares an unknown quantity with a known quantity.

With resistance in series with such a galvanometer, the current through it is directly proportional to the voltage applied to the combination and inversely proportional to the resistance. In this way direct voltages may be detected or compared. The same galvanometer may be used with a thermocouple to measure power frequencies, or with proper precautions, to determine radio frequency currents with frequencies in millions of cycles per second.

Moving Magnet Galvanometers.—One of the earliest types of galvanometers for measuring direct currents or voltage had a fixed coil and a moving magnet which is opposite to the d'Arsonval construction. Such a galva-

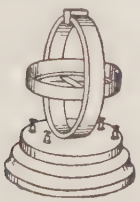


FIG. 2.—*Tangent Galvanometer*

nometer can be improvised with a coil of wire and a compass. The compass needle aligns itself with the horizontal component of the earth's magnetic field. If the compass is placed at the center of the coil and the plane of the coil adjusted parallel to the compass needle, the passage of current through the coils will produce a field at right angles to the horizontal component of the earth's field. This arrangement is shown in Fig. 2.

The combinations of the two fields will produce a resultant field at the center of the coil which is at an angle to the plane of the coil, and the compass needle will align itself with this resultant field. In Fig. 3 H is a line in the direction of the earth's field. The length of the line is proportional to the strength of the field. F is a line in the direction of the field produced by the coil. Its length is proportional to its strength. The diagonal of a rectangle formed of

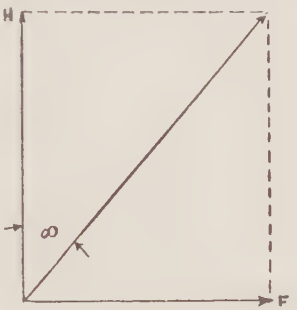


FIG. 3.

sides F and H will be proportional to the strength of the resultant field and in its direction. If α is the angle of deflection, then

$$\frac{F}{H} = \tan \alpha \therefore F = H \tan \alpha$$

The field F which produces a deflection is proportional to the strength of the earth's field and the tangent of the angle of deflection. The strength of the field F can be calculated for some coils but in any case is proportional to the current flowing through it. The current, then, is proportional to the tangent of the angle and this arrangement is called a tangent galvanometer. The strength and direction of the earth's field varies too much to permit a high order of accuracy with the tangent galvanometer.

Astatic Galvanometer.—When two magnets of equal strength are mounted on the same shaft with the north pole of one turned 180 degrees from the other, there will be no net torque on the combination when placed in a uniform field, since the torques on the magnets will be equal and opposite and therefore cancel. A non-uniformity of the earth's field (as may be produced by a steel-frame in a building) or a difference in the strength of the magnets will produce a resulting torque, and the device will not be astatic. A counter-balancing force may be exerted by a magnet in the vicinity as is done in the Thomson reflecting galvanometer, Fig. 4. Here a separate coil acts on each magnet, and since the coils are wound in opposite directions, the resulting

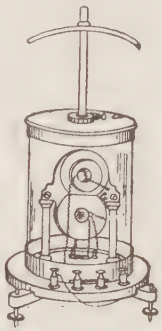


FIG. 4.—*Thomson's Reflecting Galvanometer*

torques on the two magnets are in the same direction for current through the coils. The magnets may be suspended by a light silk fiber or metal ribbon so that the suspension exerts a very feeble torque. By adjusting the position and direction of the magnet which slides on the rod at top, great sensitivity can be obtained when the system is astatic. To get the greatest sensitivity possible the equipment must be far removed from current-carrying conductors and moving masses of iron.

Shielded Moving Magnet Galvanometers.—The discovery of magnetic material of high permeability at low flux densities has made it possible to shield the moving magnet type of galvanometer from external influences. The shield usually consists of a number of concentric cans of a nickel-iron alloy, and such galvanometers are very useful.

Alternating-Current Galvanometers.—The most common galvanometer for measuring alternating current has two moving coils on the same shaft turning within two fixed coils. The current passes through all four coils in series and they are connected astatically; *i.e.*, an external magnet field exerts equal and opposite torques on the two moving coils which cancel.

For measuring alternating voltages resistance is put in series with the galvanometer described above. When the resistance is large compared to the inductance, the galvanometer can be calibrated with direct current and used on alternating current.

A wattmeter galvanometer is similar in construction. The stationary coils are wound with wire large enough to carry the line

current which traverses them. The moving coils have resistance in series and are connected across the source of voltage.

Damping.—For rapid measurements with any galvanometer it is necessary to bring the moving element to rest quickly without influencing its final position. In the d'Arsonval galvanometer the motion of the coil in the magnetic field induces a voltage in the coil. If a resistance is connected in parallel with the coil, a current will flow which will react on the magnetic field which produced the current to create a torque opposing the motion. The maximum value of this shunting resistance which will prevent oscillation is called critical damping resistance.

The moving magnet type may be damped by enclosing the magnet with a fixed conductor. The production of currents induced in the conductor abstracts energy from the moving magnet and it is quickly brought to rest.

The alternating current galvanometers are usually damped by air friction acting on a vane moving in a closed chamber.

Ballistic Galvanometers.—The most commonly used ballistic galvanometer measures the quantity of electricity which traverses it and is similar in construction to the d'Arsonval galvanometer. Quantity of electricity is measured in coulombs or ampere-seconds. A steady reading is not obtained but the maximum swing of the galvanometer is read. To facilitate reading, the natural period is made long by a comparatively massive moving element. If a capacitor is completely discharged through the galvanometer before the moving element has moved appreciably, the swings will be proportional to the quantity of the electricity in the capacitor. The same type of galvanometer is widely used for measuring magnets and magnetic fields. Similarly watt-galvanometers are used ballistically to measure watt-seconds or energy.

T. A. Rich,
General Electric Co.

Gal'veston, city, Texas, county seat of Galveston county, is situated on Galveston Bay; 300 miles west of New Orleans, and 50 miles southeast of Houston. It is served by the Gulf, Colorado and Santa Fe, the Missouri, Kansas and Texas of Texas, the Missouri Pacific, Burlington-Island, the Galveston, Houston and Henderson, the Galveston Terminal, and the Southern Pacific Railroads, and has steamship communication with the principal ports of Europe and Asia, as well as those of North and South America.

The city of Galveston lies principally on the inland side of the island and is connected with the mainland by two concrete causeways 12,642 feet in length, one of which was opened in 1938. It provides 4 lanes of traffic. Total cost was $3,500,000. A reinforced concrete sea-wall 17 feet above mean low tide, 16 feet broad at its base, and 5 feet broad at the top, extends for more than 7½ miles along the coast. As a further protection against the violence of the sea, the grade of the city was raised on an average of 7 feet over an area of 2½ square miles in 1905–11, an engineering feat which involved the pumping of some 20,000,000 cubic yards of sand from the bed of the Gulf of Mexico into the city.

The harbor is one of the finest on the Gulf of Mexico, more than $15,000,000 having been spent by the Federal Government on its improvement. The channel has a minimum depth of 34 feet, secured by the construction of two granite jetties 35,268 and 25,907 feet long respectively; while the dockage facilities are of the most modern type.

Among the city's noteworthy buildings are the City Hall and Municipal Auditorium, the County Court House, Federal Building, Rosenberg Public Library, and Ball High School. Educational and philanthropic institutions include the State School of Medicine, St. Mary's Infirmary, John Sealy Hospital, U. S. Marine Hospital, State Hospital, and several orphanages and homes. There are a number of fine churches and a notable monument to the Heroes of Texan Independence. Fort Crockett is the headquarters of the 69th Coast Artillery Regiment (Anti-Aircraft).

Commerce and Industry.—Galveston is one of the most important ports of the United States. Exports include cotton, cottonseed and cottonseed oil, lumber, wheat, and cattle. Manufacturing industries include wire and nail plants, breweries, marine repair plants and dry docks, cotton compresses, railroad shops, flour and rice mills, printing and publishing plants, and manufactures of twine and cordage, barrels, clothing, and lumber products.

The territory adjacent to the city is very fertile. Staples are sweet and white potatoes, corn, cabbage, cauliflower, celery, hay, peas, beans, and fruits. Figs grow abundantly, as well as pears, peaches, and plums. Fish and oysters are important.

Government.—Galveston was the first city in the United States to adopt the commission form of government, which it instituted following the great storm of 1900, that left the city face to face with practical bankruptcy. For a unicameral system was substituted a mayor-president and four commissioners, the latter having full charge of the four city departments—finance and revenue, police and fire, streets and public property, water-works and sewerage. These officials are elected at large, for two years The system has been remarkably successful and, with various modifications, has been widely adopted. (See Commission Government.)

Population.—The population of Galveston (1940) was 60,334. Earlier Census figures are as follows: (1890) 29,084; (1900) 37,789; (1910) 36,981; (1920) 44,255; (1930) 52,938.

History.—In 1817–21 Galveston Island was the seat of Jean Lafitte (q. v.) and his colony of smugglers and pirates. In 1836 the site of the city was purchased from the Republic of Texas by the newly organized Galveston City Company, and in 1837 the first permanent settlement was made. The port was blockaded during the Civil War, the battle of Galveston was won by the Confederates Jan. 1, 1863, and the city was occupied by Federal troops in 1865.

A destructive fire occurred in 1885, and on Sept. 8, 1900, the harbor was swept by a West Indian hurricane of such violence that the city was inundated to a depth of from 6 to 15 feet, 6,000 lives were lost, and property valued at $20,000,000 was destroyed.

Galvez, gäl'väth, Bernardo, Count de (1755–86), Spanish administrator in America, was born in Malaga and entered the Spanish army at the age of sixteen. In 1776 he became governor of Louisiana, and at once displayed decided sentiments in favor of the colonies in their dispute with Great Britain. After Spain's declaration of war against England, he became aggressive, and captured several important posts near the Gulf of Mexico—Baton Rouge (1779), Mobile (1780), and Pensacola (1781). In 1781 he was assigned to the command of the forces in the West Indies and in consequence of his successful campaigns was rapidly promoted to the rank of count, lieutenant-general, and captain-general of Cuba. In 1785, after two years' administration in Cuba, he succeeded his father as viceroy of Mexico. He was suspected of planning to make himself king of that country, but this seems to have been due chiefly to his fondness for pageantry and his erection of a fortified palace at

Chapultepec on the foundation of Montezuma's. He was an able administrator and achieved important reforms both in Louisiana and Mexico. His exploits were celebrated in the poems of de Poydras.

Galway, gôl'wā, maritime county, Connaught, Ireland; area 2,372 square miles. The coast is broken by deep inlets, bordered with rugged cliffs, and fringed with islands (Inishshark, Inishbofin, Gorumna). In the west are the wild moorland districts of Joyce's country, Connemara, and Jar Connaught; the surface is mountainous, with Bunnebeola, or Twelve Pins, reaching 2,395 feet, and the Maamturk Mountains, 2,307 feet. The eastern part is comparatively level, while in the south are the Slieve Aughty Mountains. The principal rivers are the Shannon, in the southeast, and its tributary, the Suck. Loughs Mask and Corrib partly separate the county from Mayo. Copper and marble are found, and agriculture and fishing are the chief occupations. Felt hats, friezes, linen and woolens are manufactured. Galway is the capital. Pop. (1936) 168,134.

Galway, town and seaport, Ireland, capital of county Galway, on the north side of Galway Bay; 115 miles west of Dublin. The greater part of the town is built on a tongue of land bounded on the east by Lough Athalia, and on the west by the Corrib River, the other and smaller part lying to the west, across the river. A special quarter inhabited by fishermen is known as Claddagh. Features of interest are Lynch's Mansion, a striking specimen of domestic architecture; the Church of St. Nicholas, founded in 1320; University College (formerly Queens); and the modern courthouse. The harbor is safe and spacious. The chief industries are salmon and herring fisheries, distilleries, flour mills, and foundries. Exports include wool, marble, and agricultural produce. Nothing is known of Galway until 1124, when a fort was erected there by the Connaught men. Pop. 13,255.

Galway Bay, a spacious inlet of the Atlantic Ocean, on the west coast of Ireland; about 30 miles long and averaging 10 to 12 miles wide. The Aran Isles form a natural breakwater across its entrance.

Gama, gä'mā, Vasco da (1469–1524), Portuguese navigator, the pioneer of European commerce and empire in the Far East, was born in Sines, in Alemtejo. Chosen leader of an expedition to explore the east coast of Africa, Gama doubled the Cape of Good Hope in November 1497, and reached Calicut, India, in May 1498, thus opening the ocean route to the East. Returning to Portugal in 1499, he ventured on a second voyage to India in 1502. He founded the colonies of Mozambique and Sofala, on the east coast of Africa, bombarded Calicut, and returned to Lisbon (1503) with valuable cargo. Twenty-one years afterward (1524) he was chosen viceroy of Portuguese India, but died the same year at Cochin. He is immortalized in the *Os Lusiados* of Camoëns. An account of his voyages, written by a companion, Alvaro Velho, has been translated into English as *A Journal of the Voyage of Vasco da Gama* (Hakluyt Soc., 1898). Consult, also, Lord Stanley of Alderley, *The Three Voyages of Vasco da Gama;* G. M. Towle, *Vasco da Gama;* V. T. Harlow, *Voyages of Great Pioneers* (1929); J. P. Alaux, *Vasco da Gama* (1931).

Gamaliel, gā-mā'li'el, the Pharisee who instructed the apostle Paul in the law (Acts xxii. 3), and whose intervention saved Peter and the other apostles from the summary condemnation of the Sanhedrin (Acts v. 34–40). He was the grandson of Hillel, the founder of the more liberal Pharisaic school, and was its most distinguished ornament, being known as 'the beauty of the law.' He was an enthusiastic student of Greek literature, and showed a notable kindness and courtesy toward those not of the Jewish faith. The stories of his conversion and baptism, however, must be dismissed as apocryphal. See Conybeare and Howson's *St. Paul.*

Gamberelli. See Rossellino.

Gambetta, *Fr. pron.* gän-bätä' Léon (1838–82), French statesman, was born in Cahors. He was educated in the lycée of his native town, studied law in Paris, and was called to the bar in 1861. He first attracted attention by his defense of a journalist obnoxious to the Empire, in consequence of which in 1869 he was elected to the Assembly as a radical member from Paris and Marseilles, winning his seat against Carnot and Thiers respectively. He opposed the constitution favored by Napoleon and in a brilliant speech, delivered in May 1870, advocated an organized democracy. After the fall of the Empire following the disaster at Sedan, he became Minister of the Interior in the provisional government and, escaping from Paris in a balloon, went to Tours, where by his eloquence and leadership he did much to restore his country's confidence and courage. In 1871, when the National Assembly was to decide between continuation of the war and conditions of peace, Gambetta favored the former policy and on the Assembly's voting for the latter, resigned his position and went to Spain. On his return to France he entered the Assembly as member from Paris and gave his support to Thiers. Towards the latter part of 1871 he saw the fulfilment of a dream long cherished, the establishment of the journal *La République Française,* a strong influence for the spread of democratic principles. He bitterly opposed clericalism and the attempt of MacMahon to restore the temporal power of the Pope. In 1879 he became president of the Chamber of Deputies and two years later was made premier. During his brief ministry he endeavored to introduce the *scrutin de liste,* in which the elector should vote for all the deputies and senators of the department on one general ticket, but the measure was defeated. He died in 1882 as the result of a pistol wound, accidentally inflicted. Consult P. B. Gheusi, *Gambetta, Life and Letters;* J. Reinach, *Léon Gambetta;* P. Deschanel, *Gambetta.*

Gam'bia, British dependency on the west coast of Africa, extending 250 miles along each bank of the Gambia River, seldom exceeding a width of 12 miles; area 4,132 square miles. The surface is flat and marshy, and the climate fairly healthful, but lack of rain for a large part of the year is a serious handicap to agriculture. The principal products are ground nuts, rubber, and palm kernels. Bathurst, the capital and chief town, stands on the Island of St. Mary and is administered as a crown colony. The remainder of the dependency is administered as a protectorate. Pop. (1931) 185,150, mostly Mohammedan Negroes.

Gambia, river, West Africa, rises in the Futa-Jallon plateau, flows west across Gambia, and enters the Atlantic at Bathurst, about 100 miles southeast of Cape Verde. It is navigable as far as Barraconda, about 250 miles from its mouth. Owing to its devious course, its total length is nearly 1,000 miles, although a direct line from its mouth to its source is only about 300 miles.

Gambier, gam'bēr, or Gambir, the Malayan name for an extract made from the leaves and small branches of *Uncaria gambir* and *U. acida,* rubiaceous shrubs cultivated in Singapore and Java. In common with cutch or catechu, gambier is sometimes called *terra japonica.* It is im-

ported chiefly from Singapore, in the form of brown porous, earthy looking cubes, and is employed as a dye-stuff to produce browns, olives, and drabs, being much used to dye khaki. It is also used in medicine as an astringent, and the Malays chew it with betel leaf to relieve affections of the mouth.

Gambier, James, Lord (1756–1833), British admiral, was born in New Providence, in the Bahamas. He took part in the relief of Jersey in 1779 and in the capture of Charleston, S. C., in 1780, and in 1794 won distinction for his part in the victory off Ushant. He was made vice-admiral in 1799, and in 1802 was sent to Newfoundland as governor and commander-in-chief. In 1805 he became admiral and two years later commanded the fleet which blockaded and bombarded Copenhagen, for which service he was raised to the peerage. In 1809 he was in command of the Channel fleet which blockaded the French fleet in Basque Roads but failed adequately to support Cochrane's attempt to destroy it. In 1814 he was one of the commissioners for negotiating peace with the United States and in 1830 was promoted admiral of the fleet.

Gambier Islands, a group of ten unimportant islands in the Pacific Ocean in lat. 23° 15′ s. and long. 134° 45′ w., immediately to the south of the Low Archipelago; area, 6 square miles. Only four are inhabited, and all are rocky and barren. The soil of Mangareva, the chief island, is fairly fertile and produces cocoanuts, fruits, and coffee. Quantities of pearl-shell are found in the surrounding waters. Rikitea is the principal town. The islands have formed a French protectorate since 1844. Pop. 500.

Gambit. See Chess.

Gam'ble, Hamilton Rowan (1798–1864), American public official, was born in Winchester, Va., and for a time was a student at Hampden-Sidney College. Having removed to Missouri (1818), he was elected secretary of state (1823), and afterward became chief justice of the State Supreme Court. At the beginning of the Civil War he was chosen by the Missouri Constitutional Convention to be the head of the provisional government established after Governor Claiborne Jackson had joined the secession movement. Confronted with many grave problems, he proved himself a wise and patriotic official. In 1862, in order to maintain peace, he placed the State troops at the disposal of General Schofield. The following year he was unsuccessful in inaugurating a policy for the gradual emancipation of the slaves and failed of re-election.

Gam'bling, according to the law, an agreement between two or more persons whereby they risk money, or anything of value, upon the result of a game of chance, in which one or more may win and the other or others lose, the term 'game' including every possible scheme or contrivance for amusement which involves a test of skill or endurance, or any element of chance. Thus, a game of billiards, involving skill, played upon a wager between the players, is gambling; a game of roulette, involving only chance, also comes within the definition. The size of the stakes is immaterial, and even games in which it is understood between the players that the loser is merely to pay for drinks, cigars, etc., constitute the offence. Games played on condition that the loser pay for the use of the apparatus, as a billiard table, are generally also considered gambling, but there are decisions to the contrary. Exhibition contests for prizes offered by a third person, not a party to the contest, as an exhibition bicycle race, are not regarded as gambling.

Practically all civilized countries have sought by law at least to limit, if not suppress entirely, gambling activities. Roulette wheels, the keeping of gaming houses, faro, various lotteries, bookmaking, and wheels of fortune are among the many forms of gambling generally forbidden, but the law varies in different countries and in the different States of the United States.

Gambling is a vice confined to no nation or period. It was popular in Babylonia, China, and India many centuries before Christ, was a pastime of the Greeks and Romans, and was practised in Germany in the first century of the Christian era.

In England gambling was early made the subject of legislation. The first law against it was enacted in 1661, lotteries were made illegal in 1698, and the Acts of 1845, 1853, and 1906 all aimed at the curtailment of gambling. France suppressed public gaming-tables in 1838, and in 1872 Germany closed her gaming establishments, the most celebrated of which were Baden-Baden and Homburg. Belgium forbade gambling in the kingdom in 1902, and at the present time the only place in Europe where gambling is openly permitted is Monte Carlo (q. v.), in Monaco.

In the United States the keeping of a gambling house is indictable at common law, and most of the States have more or less stringent laws against gambling.

For typical gambling games see Fan Tan; Faro; Poker; Rouge et Noir; Roulette; Vingt-et-Un. See also Betting; Lottery; Monte Carlo.

Consult P. de Ketchiva, *The Devil's Playround: Monte Carlo* (1934); P. Green, *Betting and Gambling* (1935); H. N. Pringle, *Gambling in the United States* (1935).

Gamboge, gam-bōj′ *or* bōōj′, or Camboge, a gum resin (80 per cent pure resin; 20 per cent gum) obtained from the East Indian tree *Garcinia cambogia*. When the bark of the tree is wounded the gamboge exudes as a thick, viscid, yellow juice, hardening on exposure to the air. It is generally collected in a joint of bamboo, and is marketed in the form of sticks or cylinders. It is brittle and nearly odorless and when of good quality is of a rich, orange brown tint. The resin is partly soluble in alcohol, ether, and ammonia. Gamboge is chiefly employed as a water color pigment to produce bright yellow, or, mixed with blue, to make a dull green. It is useful as a glazing color but is not permanent in sunlight. It is employed in medicine as a cathartic or diuretic, but its action is too drastic to permit of common use.

Gambrel, old French *gamberel,* a butcher's tool, made of a bent piece of wood or iron to extend and hang a carcass on; it also means the hock of an animal, particularly the horse.

A *gambrel-roof,* in architecture, is a roof the ends of which are cut off in a vertical plane, with sides having two slopes, somewhat like a horse's gambrel or hock, the upper slope being comparatively flat and the lower one much steeper. Such roofs are frequently found in American wooden (i.e., 'frame') houses in the form of a gabled roof in which the slope of the two sides is broken. Consult Russell Sturgis, *Dictionary of Architecture and Building* (2 vols.). See Roof.

Gambri'nus, a mythical king of Flanders, who is credited with the invention of beer. His figure is familiar in German beer cellars, often seated astride a cask, a foaming tankard in his hand.

Game. See Game Laws; Hunting; Shooting.

Game Birds. See Game Laws; Duck; Grouse; Partridge; Quail; Pheasant; Snipe; Turkey; Woodcock.

Game Laws regulate the hunting, killing, and taking of wild birds and animals, and may also include measures for the protection of fish and fishing rights.

Game Laws

In Great Britain hunting was long considered a royal sport, and laws were early enacted that reserved the privileges of the chase and of fishing to the sovereign and persons of rank and fortune. Since 1831 any British citizen may obtain a license to kill game on the payment of a prescribed fee.

In the *United States* the ownership of migratory birds is considered to be vested in the Federal Government, while the title to other game and fish is considered to be vested in the several States. Even the owner of land has no property rights in the game which roams over it or the fish in its waters; though he may claim the exclusive right of hunting on and fishing from his land, and any one who comes upon it for such purposes, without permission, may be held liable as a trespasser.

Apart from the police power of the State, the ownership of fish and game being in the people of the State, and no individual having any property rights to be affected, it necessarily results that the legislature, as the representative of the people, may withhold or grant to individuals the right to hunt and kill game, or qualify or restrict that right. In other words, to hunt and kill game is a privilege granted either expressly or impliedly by the sovereign authority, not a right inherent in each individual; consequently nothing is taken away from the individual when he is denied the privilege.

The earliest game law in the United States of which there is authentic evidence was enacted by the General Assembly of New Jersey in 1679, prohibiting the exportation of dressed deer skins from deer killed by the Indians. Most of the other colonies also passed protective measures, and since the adoption of the Federal Constitution a great number of game laws have been enacted by the various States.

The chief provisions of the *State Game Laws* are those establishing open and close seasons; prescribing the manner of taking or killing game; limiting the amount to be so taken or killed; prohibiting the sale or exportation of game; and requiring a license and the payment of a license fee. State Game Commissions are usually established to enforce these laws, and to carry on the work of propagation. The State laws have many other provisions in common, especially in regard to big game, as moose, deer, etc. Short open seasons are prescribed for such animals, limitations are set as to the number any one person may kill in a year, and in some States hunting of them is prohibited absolutely for a period of years. Regulation of size of fish to be taken, restrictions on hunting with dogs, against the use of lights, certain weapons and devices, and the use of ferrets and weasels are also common provisions. The export of game killed or captured within the State at any time, as well as the possession or sale of game during close seasons, is prohibited, restricted, or regulated. Most States require both residents and non-residents to procure licenses for hunting either all or certain kinds of game; while a few States require only non-residents to obtain licenses. Hunting and fishing on Sunday may also be prohibited.

In general, the times in which the young are produced are made *close* or *protected seasons;* the times when increase will not be interfered with, and the game is best for human consumption, are selected as *open seasons.*

Federal Game Laws were enacted for the Indian country in 1832, for the District of Columbia in 1878 and 1899, for Yellowstone National Park in 1894, and for Mount Rainier National Park in 1899. The first comprehensive Federal legislation, however, was the Lacey Act, passed in 1900, which gives the Department of Agriculture enlarged powers as to the introduction and preservation of wild animals and birds in the United States, and recognizes and supplements the State laws on the subject. It forbids interstate shipment of game killed or shipped in violation of local laws; requires that packages containing dead animals or birds shipped by interstate commerce shall be plainly marked so that the name and address of the shipper and the nature of the contents may be readily ascertained; and provides that the dead bodies of wild animals and birds transported into any State shall become subject to the operation of that State's laws.

In 1913 Congress passed the *Federal Migratory Bird Law,* giving the Federal Government control of all migratory game and insectivorous birds which do not remain permanently within the boundaries of one State, and authorizing the Department of Agriculture to prescribe and fix closed seasons for such birds. By regulations promulgated under this Act, spring shooting is everywhere denied, and the fixed rule is adopted that in no part of the country may there be shooting after the game has started for its breeding grounds in the North.

In 1916 the United States and Great Britain negotiated an agreement for the protection of insectivorous and game birds migrating between the United States and Canada. The chief provisions are that no bird important to agriculture because of insect-destroying proclivities shall be shot at any time; that no open season on any species of game birds shall extend for a longer period than three and one-half months; and that both countries shall restrict open seasons on game birds so as to prevent their being taken during the breeding season. An Act of the Canadian Parliament approved Aug. 29, 1917, insures the execution of the terms of the treaty in Canada; while a bill providing for its enforcement in the United States was passed July 3, 1918.

Canada, with its enormous area and sparse population, is one of the great game preserves of the world, especially in the Laurentian, Prairie, and Pacific regions. While certain animals, such as the buffalo, were almost exterminated in earlier times, the last twenty years have seen a wild life conservation movement originated by the Commission of Conservation and reflected in both Dominion and Provincial legislation, the latter creating long close seasons for various varieties of game, and both establishing in their public lands great perpetual game preserves, extending in the aggregate to more than 19,000,000 acres.

Game Preserves are parks or tracts set aside for the protection of game, In the United States, national game preserves include Yellowstone National Park; National Zoological Park, D. C.; Rock Creek Park, D. C.; Sequoia National Park, Cal.; Yosemite National Park, Cal.; General Grant National Park, Cal.; Mount Rainier National Park, Wash.; Crater Lake National Park, Oregon; Wind Cave National Park, S. D.; Glacier National Park, Mont.; Rocky Mountain National Park; Wichita Game Preserve, Okla.; Grand Canyon Game Preserve, Ariz.; Muir Woods National Monument, Cal.; Montana National Bison Range; Niobrara Reservation, Nebraska; Mount Olympus National Monument, Washington; Munkuntuweap National Monument, Utah; Colorado National Monument; Sieur des Monts National Monument, Me.; Winter Elk Refuge, Wyo.; Sullys Hill National Park, N. D.; Mount McKinley National Park, Alaska; Pisgah National Forest and Game Preserve, N. C.; Billy Meadows Pasture, Oregon; Lincoln, New Mexico; Santa Rita, Arizona; Alexander Archipelago, Alaska; and Absaroka, Mont.; as well as more than 100 national bird refuges established for affording protection to important breeding colonies of water birds, or to furnish refuges for migratory species on their northern or southern flights, or

during winter, and a few reservations for aquatic mammals and birds and for fish.

Game Reservations have also been set aside by most of the States. One of the largest of these is the Superior State Game Preserve in Northern Minnesota, which covers 1,290,000 acres. In addition to these, a number of privately owned tracts are held as game preserves.

Among the chief Canadian game preserves maintained by the Dominion Government are: Jasper Park and Rocky Mountains Park, Alberta, 4,400 and 2,751 square miles respectively; Kootenay, Glacier, and Yoho Parks, British Columbia, 587, 476 and 468 square miles respectively; and many smaller parks, including the Buffalo Park of 159 square miles, near Wainwright, Alberta, containing the largest buffalo herd now in existence (8,000 head). The province of Ontario maintains Algonquin Park, 4,000 square miles, as a game preserve, and the province of Quebec Laurentides Park of 2,750 square miles.

Consult publications of the U. S. Biological Survey; H. Chase's *Game Protection and Propagation in America* (1913); Grinnell and Sheldon's *Hunting and Conservation* (1925).

Games. See PLAY; also ATHLETICS and articles referred to under that heading.

Games, Olympic. See OLYMPIC GAMES.

Games, Pythian. See PYTHIA.

Gamete. See BIOLOGY.

Gametophyte. See ALTERNATION OF GENERATIONS.

Gamewell, FRANCIS DUNLAP (1857–), American missionary, was born in Camden, S. C., and was educated at Cornell University and Dickinson College. In 1881–4 he was engaged in educational work in Peking, China, and in 1884–7 was superintendent of the West China Mission. He was professor of physics and chemistry in Peking University in 1889–1900 and in the latter year was chief of staff in the British Legation during the siege of Peking. From 1901 to 1908 he was field and executive secretary for the Methodist Board of Foreign Missions, New York. In 1912 he became general secretary of the China Christian Educational Association. He is the editor of *The Educational Review*.

Gaming. See GAMBLING.

Gamma Rays. See RADIOACTIVITY.

Gammarus, a genus of amphipod Crustaceæ, to which belongs *G. pulex*, a common freshwater form. See AMPHIPODA.

Gamtoos, gäm'tōs, or CAMTOOS, river, Cape of Good Hope, South Africa, rises on the plateau of Great Karoo, flows southeast, and enters the sea at St. Francis Bay, 50 miles west of Port Elizabeth. Length, 200 miles.

Gam'ut, popularly, the musical scale of tones and semitones that makes the octave; by association, the lines and spaces on which the notes are printed.

Gandara, gän'dä-rä, town, Samar, Philippines, on the Bachao Bañgakon River, 17 miles north of Catbalogan. It was nearly destroyed during an engagement with the insurrectionists in 1899. Pop. 13,000.

Gandhi, gän'dē, MOHANDAS KARAMCHAND (1869–), known commonly as MAHATMA GANDHI, East Indian political leader, was born in Porbandar. He studied law in London, was called to the bar at the Inner Temple, and on his return to India was admitted as an advocate of the Bombay High Court. In 1893 he went to South Africa and there initiated a policy of passive resistance as a protest against the indignities suffered by the Indian population. He organized the Indian Volunteer Ambulance Corps in London early in the war, and returning to India in 1915, did valuable service in war recruiting. In 1919 the passage of the Rowlatt Bill (see INDIA), designed still further to curb the liberty of the Indians, caused Gandhi to institute a policy of non-co-operation and passive resistance to the British government which led to serious disorders in the Punjab and finally to his arrest and trial. On March 18, 1922, he was sentenced to six years imprisonment but in February 1924 he was released after having undergone an appendectomy in jail. His party had in the meantime chosen other leaders, and Gandhi found himself a weakened political force. In December 1925 he announced his intention of retiring from public life for a year. The next five years marked a time of personal uncertainty and doubt; but in January 1930 Gandhi again asserted himself by insisting upon civil disobedience as a protest against the salt excise laws. On May 5, 1930, he was again arrested and imprisoned. In January 1931 he was released, and later in the year his conferences with the viceroy had their consequence in the Delhi Pact. Another event in which Gandhi participated during that year was the Round Table Conference in London. He was imprisoned once again in 1933, and in protest he began and maintained a self-imposed fast which gained worldwide attention. After a short time he was set free. In 1937 upon the return of his party to power Gandhi advised that elected members to the provincial congress accept office only if the governors agreed not to use their right of veto. In spite of the fact that in January 1937 Gandhi announced his retirement from politics, he achieved two years later, in the spring of 1939, two considerable political victories. The first was a protest against the administration of Thakore Saheb of Rajkot. His method of protest was again the self-imposed fast. After four days Saheb capitulated and the matter was submitted to the Indian chief justice. The second successful achievement was the defeat of Gandhi's principal opponent, Subhas Chandra Bose, who was forced to resign as president of the Congress. A loyal Gandhi follower, Rajendra Prasad, became president. Gandhi had regained his power. He sent an appeal for peace to Adolf Hitler in the summer of 1939, and upon the outbreak of serious hostilities inquired into British intentions concerning Indian participation in the war. One of the objectives of the inquiry was the independence of India at the end of the war. Because he believed the British answered evasively, Gandhi ordered eight provincial ministers to resign in protest.

Gandia, gän-dē'ä, seaport, in the province of Valencia, Spain; 35 miles southeast of Valencia. Features of interest are the Palace of the Borjas or Borgias, and the Colegio de Escuela Pia, founded by St. Francis of Borgia. The harbor is at Grao, about two miles away. Raisins, oranges, wine, and onions are exported. Pop. 12,893.

Ganges, gan'jēz, the great river of Northern India, prominent in both the religion and geography of the East. Its basin, which lies between the Himalayas and the Vindhya mountains, and extends eastward to the mountain barrier between Burma and Bengal, is a rich alluvial plain, remarkable for its fertility and density of population. It covers 390,000 square miles, and its length is 1,557 miles. Rising in a Himalayan ice cave known as Bhagirathi, in about 31° N. and 79° E., in the state of Garhwal, the Ganges descends as a roaring torrent to Gangotri (alt. 10,319 ft.), where there is a temple famed as a pilgrim resort. It receives the Alaknanda about 130 miles from its source, and enters British India a little above Hardwar, to which it is navigable for river craft. Thence, with many a shoal and rapid in its winding stream, it flows S.E. past Farukhabad to Cawnpur, the highest point to which loaded barges can ascend. At Allahabad it receives the Jumna, which also has its source in Garhwal, and drains, by means of its main stream and its tribu-

taries (Chambal and Betwa), Rajputana, Sindh, and Bundelkhand. Soon after leaving Allahabad the river turns eastward, and passes Mirzapur, Benares, Ghazipur, Patna, Monghyr, and Bhagalpur, receiving on its left bank the Gumti, the Gogra, and the Gandak, and on its right bank the Son. Some one hundred and forty miles from the sea it unites with the Brahmaputra to form the largest delta in the world. (See SUNDARBANS.) The main outlet of the combined streams is the broad estuary of the Megna, while the principal channel of navigation to Calcutta is the Hugli, the westernmost distributary of the delta. A glacier-fed river, the Ganges is replenished by perennial streams, especially in the hot season, when the evaporation of its waters is greatest. Between the rivers Ganges and Jumna (the Doab) is a system of irrigating canals, known as the Ganges Canals, which fertilizes some 2,000 sq. m. The Upper Ganges Canal taps the main stream of the Jumna a little above its confluence with the Betwa; it exceeds 1,000 m. in length, some 400 m. of which are open for navigation. The Lower Canal, begun in 1873, has a main channel of 700 m., and branches not far short of 3,000 m. 'Mother Ganges' is held in peculiar veneration by the Hindus, and every foot of its course from its source to the sea is holy.

Ganglion, or KNOT. (**1.**) A collection of nerve cells on the course of a nerve, forming an obvious swelling. (See NERVOUS SYSTEM.) (**2.**) In surgery, the swelling caused by the collection of fluid in the fibrous sheath which surrounds a tendon. It arises from inflammation of the tendon-sheath, and occurs most often at the back of the wrist, over one of the extensor tendons of the hand. Sometimes the cyst may be broken by firm pressure or by a smart blow, and the fluid be thus dispersed; or a puncture may be made, with proper antiseptic precautions, and the fluid be pressed out. Sometimes counter-irritation with iodine causes absorption.

Gangrene, or MORTIFICATION, is a local death which results in a portion of the body, generally a limb or part of a limb, undergoing putrefaction or mummification, with subsequent separation from the healthy tissues. Gangrene results from the action of bacilli upon tissues whose vitality has previously been lowered. Any interference with nutrition conduces to the onset of gangrene. Constriction of a part, by diminishing the blood supply, may lead to local death. Clinically, two forms of the disease are

International News Photo

MAHATMA GANDHI

recognized—dry and moist gangrene. In dry gangrene the dead part shrivels up and assumes a mummified appearance; in moist gangrene, which is more associated with venous obstruction than the other, the parts are soft, putrescent, and malodorous, while in some cases the development of putrefactive gases leads to the formation of bullæ beneath the dead skin. Hospital gangrene was the scourge of surgeons before the era of Lister and the advent of antiseptics.

Treatment.—In many cases the surgeon must content himself with maintaining the patient's strength, checking the advance of the disease, and combating septic infection, until spontaneous separation of the dead part ensues. Sometimes, however, if the gangrene is spreading rapidly, amputation of the necrosed parts is necessary.

Gangue is the non-metalliferous vein-stuff in which metallic ores occur. It is usually calcite, quartz, barytes, or fluor spar, and is often crushed and separated from the valuable ores by various methods of extraction or milling.

Gangway. In the early days of sailing line-of-battle ships and frigates, the gangway was a broad passageway along the ship's side, connecting opposite ends of the partial upper decks (quarter-deck, half-deck, etc.) which only extended part way from stem and stern. The term is now commonly applied to the passageways on each side of the upper deck immediately forward of the quarter-deck and to the aperture in the side of the ship which affords access to the accommodation ladder. Less specifically the term is applied to any passageway or thoroughfare.

Ganjah, the name given to the dried plants of Indian hemp before the resin has been removed. It is used chiefly for smoking, and has strong intoxicating and narcotic properties.

Gannet, or SOLAN GOOSE (*Sula bassana*), a large marine bird which nests in scattered localities

Gannet.

in most parts of the world where remote rocky cliffs or islets favor its security. Its specific name refers to the fact that it has always been a denizen of Bass Rock—a famous craggy islet on the coast of England. This bird also nests on Bird Rock in the Gulf of St. Lawrence, and other species exist in the tropics. It belongs to the same sub-order as the cormorant, and may be recognized by the fact that, as in the latter, all four toes are united by a web. The bill is long and strong, and compressed at the point, the face and throat naked, the nostrils obliterated. In adult life the plumage is white, save for the black primaries and a buff patch on the head or neck; but the young are dusky, and do not acquire the white plumage till their sixth year. The nest contains only one egg.

Gannett, EZRA STILES (1801–71), American clergyman, grandson of Ezra Stiles, was born at Cambridge, Mass., and graduated (1820) at Harvard. He completed the course in the Harvard divinity school in 1823, and the following year was made colleague of William Ellery Channing in the Federal Street Church (Unitarian) at Boston, succeeding him as pastor in 1842. Dr. Gannett experienced a stroke of paralysis in 1836, but continued work until killed in a railroad accident in 1871. He took a leading part in the early Unitarian movement in New England, and was president of the American Unitarian Association from 1847 to 1851, having long previously served as its secretary. He was an overseer of Harvard from 1835 to 1858. Dr. Gannett was editor of several religious papers, including the *Christian Examiner*. See *Ezra Stiles Gannett: A Memoir*, by his son (1875).

Gannett, HENRY (1846-1914), American geographer, born in Bath, Me., and graduated at the Lawrence Scientific School in 1869. In 1882 he was appointed geographer of the United States Geological Survey, and was geographer of the 10th, 11th, and 12th censuses. His *Boundaries of the United States and of the Several States and Territories* ran through three editions (1885, 1900, and 1904), and his *Dictionary of Altitudes in the United States* through four (1884, 1891, 1899, and 1906). He also published *Geographic Dictionaries of Connecticut* (1894), *Massachusetts* (1894), *New Jersey* (1894), *Rhode Island* (1894), *Kansas* (1898), *Texas* (1904), *Utah* (1900), *Virginia* (1904), *West Virginia* (1904), *Maryland* (1904), *Delaware* (1904), *Indian Territory* (1905), and a *Statistical Atlas of the United States* (1898 and 1903).

Gannister, or GANISTER, a fine, compact, hard sandstone which occurs in some parts of the Carboniferous rocks of the north of England. It is used for grindstones and for making the hearths of furnaces. The term is also used for an artificial mixture of ground quartz and fire-clay used in the manufacture of refractory wares such as furnace linings.

Ganoids, or GANOIDEI, an order of fishes which includes seven living genera, whose members are all found in fresh water—*viz.* Acipenser (the sturgeon), Amia (the bow-fin), Lepidosteus (the gar-pike), Polyodon (the spoon-bill), Polypterus, Calamoichthys (the reed-fish), Scaphirhynchus (the shovel-beak). The members of these genera are distinguished from their nearest allies, the teleosteans, or bony fish, by the presence of a spiral valve in the intestine, the fact that the tail is frequently heterocercal or unequally lobed, the skeleton often, at least in part, cartilaginous, and the skin furnished with bony scales or scutes (ganoid scales). On palæontological grounds it is now customary to unite ganoids and teleosteans in one order or division, the Teleostomi, and to drop the term ganoid altogether. Great numbers of these fishes are known as fossils. See Zittel-Eastman, *Text-book of Paleontology* (1902).

Gans, EDUARD (1798–1839), German jurist, born at Berlin of Jewish parentage. He is the principal exponent of the juristic school which sought to found law upon philosophical principles, in opposition to the historical school of Savigny. Gans's views are expounded chiefly in his Introduction to his *Scholien zum Gajus* (1821) and *Das Erbrecht in weltgeschichtlicher Entwickelung* (1824–35). He was professor of law at Berlin University from 1825. His other works include *System des römischen Zivilrechts* (1827), *Vermischte Schriften* (1834), and an edition of Hegel's *Philosophie der Geschichte* (1837).

Gansevoort, PETER (1749–1812), American soldier, was born at Albany, N. Y. As major of the Second New York Regiment he accompanied (in 1775) Montgomery's expedition into Canada. Having been promoted to be lieutenant-colonel in 1776, he was placed in command of Fort George, and the next year, as colonel, in command of Fort Stanwix (or Schuyler). He successfully defended it for twenty days against the British commander, St. Leger, and his Indians and Tories, and thereby prevented his junction with Burgoyne. He was finally relieved by Benedict Arnold's reinforcements, and was thanked by Congress for his services in thus paralyzing the movement of St. Leger's large force. In 1779, at the head of a body of picked men under Sullivan, he captured a large body of

Indians in the lower Mohawk castle. In 1781 he was appointed brigadier-general of the N. Y. militia, and in 1809 of the U. S. army. In the boundary dispute over the New Hampshire land grants, many of the insurgent troops belonged to his brigade, and he vainly tried to pacify them. In later years he was commissioner of Indian affairs, commissioner on frontier fortifications, and military agent.

Gantang, mountain pass, Bashahr state, India, leading from Punjab E. into Tibet. Its altitude is 18,295 ft.

Gantur, or GUNTUR, tn., Kistna dist., Madras Presidency, India, 50 m. W.N.W. of Masuliptam; has grain and cotton trades. Pop. 25,000.

Ganymede, son of Tros, king of Troy. He was held to be the most beautiful of men, and was carried off by the gods to be the cupbearer of Zeus, and to dwell in Olympus. See Gayley's *Classic Myths in English Literature* (1893).

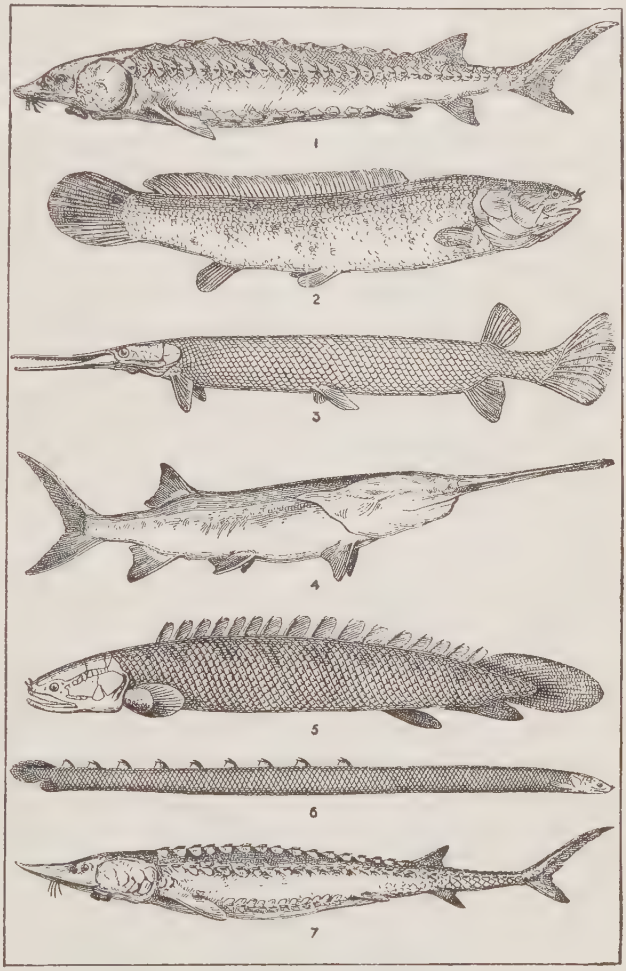
Gap (anc. *Vapincum*), tn., dep. Hautes-Alpes, France, 48 m. S.E. of Grenoble; has manufactures of silk, cement, and woollen goods, also distilleries and sawmills. Pop. 11,018.

Gapan, pueb., Nueva Ecija, prov. Luzon, Philippines, 3½ m. E. of San Isidro, at the junction of four roads. Pop. 11,278.

Gap Canal, or CANAL DU DRAC, connects the Drac and Durance rivers. Its total length is 445 m.; it was completed in 1888, and is valuable for irrigation.

Gapes. See POULTRY, DISEASES OF.

Gapon, FATHER (1839–1906), Russian priest and agitator, born at Poltava. He studied for the priesthood, but, on account of his strongly radical views, was only admitted under limitations which did not allow of his holding a charge. His energy and force of character, and his untiring zeal and democratic sympathies, gained for him a strong hold over the working classes in St. Petersburg. Father Gapon came prominently before the public as the leader in the strikes in St. Petersburg during the winter of 1905, and especially of the crowd of working men which was fired upon by the troops in St. Petersburg on Jan. 22 of that year. Immediately thereafter Father Gapon fled, and, after passing through Germany and France, lived for some time in London, where he published *The Story of My Life* (1905). He reappeared in St. Petersburg in Dec., 1905, and soon thereafter the revolutionary papers charged him with being in the pay of Premier Witte and of working against the revolution. In April, 1906, a body found in a country house near St. Petersburg was identified by Gapon's lawyer as that of the priest. At the same time a communication appeared in the revolutionary newspapers, signed by the 'Revolutionary Tribunal,' stating that Gapon had returned to St. Petersburg, had been executed. In his *Life* Gapon says that he had received money from the police authorities to help him carry out his labor movements before the massacre (of Jan., 1905), and that he had done so to throw the police off the scent. The police at that time were encouraging the organization of



Types of Ganoid Fishes.

1. Acipenser sturio. 2. Amia occidentalis. 3. Lepidosteus osseus. 4. Polyodon osseus. 5. Polypterus bichir. 6. Calamoichthys calabaricus. 7. Scaphirhynchus platyrhynchus.

accepted money from subordinates of Witte to betray the revolution, and had offered a large money bribe to one of the revolutionary leaders if he would give information leading to the arrest of four of the revolutionists. Whereupon, the communication continued, he had been sentenced to death, and the sentence had labor unions, on the theory that this influence would counteract revolutionary tendencies.

Gar, a name given to several orders of fishes having long, sharp snouts. See GAR-PIKE.

Garabit, viaduct on the railway from Béziers to Clermont-Ferrand, dep. Cantal, France; was constructed by M. Eiffel. It has

a total length of 1,852 ft., and a span of 542 ft. It was completed in 1885.

Garag, or GADAG, tn., Dharwar dist., Bombay, India, 42 m. S.E. of Dharwar; has cotton and silk manufactures. Pop. 30,652.

Garamantes, ancient people of N. Africa, dwelling in Phazania (now Fezzan); their chief city was Garama. They were conquered by Cornelius Balbus the Younger (B.C. 20).

Garat, PIERRE JEAN (1764–1823), French singer, born at Ustaritz, near Bayonne; was chosen to give singing lessons to Marie Antoinette. After the outbreak of the revolution he removed to Hamburg. In 1796 he was appointed professor of singing at the conservatory of music at Paris. He composed many charming songs. Sardou has a play (1860) named after him.

Garay, JANOS (1812–53), Hungarian poet, dramatist, and author, was born at Szegszárd (Tolna). His epic poem, *Csatár* (1834) was followed by several historical dramas, of which the most famous was *Arbocz* (1837). The romance in verse, *Frangipan Kristófné* (1846), and especially the historical poem, *Szent László* (1850), are widely known. His collected poems were published by F. Ney (1854). See *Life* by Ferenczy (1883).

Garb, in heraldry, a sheaf of wheat. If of any other grain, the kind must be specified.

Garbage, DISPOSAL OF. See REFUSE DISPOSAL and REFUSE DESTRUCTORS.

Garborg, ARNE (1851–1924), Norwegian author, born in Jæderen. Garborg began his career as an extreme literary realist—*e.g.* in *En Fritenkjar* (1881); *Bondestudentar* (1883); *Fortcljingar og Sogur* (1885); *Mannfolk* (1886); *Hjaa ho Mor* (1890). In his later novels, however, a strong religious feeling prevails. This period is marked by *Trætte Mænd* (1890) and *Fred* (1892), both powerful pieces of analysis, but pessimistic. Garborg has also written an exquisite collection of poems entitled *Haugtussa* (1899 and 1901). Further, he has attempted the drama in *Uforsonlige* (1888) and *Læraren* (1896), and biography in *Jonas Lie* (1893). See his own charming autobiographical *Kolbotnbrev* (1890).

Garcia, MANUEL DEL POPOLO VICENTE (1775–1832), Spanish tenor singer and musical composer, born at Seville. He had great success in Paris in Paer's opera *Griselda*. In Italy, his opera, *Il Califo di Bagdad*, was favorably received, and his singing much admired. At Paris he trained many renowned singers, among them his daughters, Maria (Madame Malibran) and Paulina Viardot-Garcia. He visited the U. S., Mexico, and South America, and was everywhere enthusiastically received.

Garcia, MANUEL (1805–1906), born at Madrid and son of the above, won a brilliant reputation as a teacher of singing, first at the conservatory in Paris (from 1842) and afterwards in London (from 1850). He wrote *Mémoire sur la Voix Humaine* (1840) and *Traité de l'Art du Chant* (1841; Eng. trans., *Hints on Singing*, 1894). He was also famous as the inventor of the laryngoscope (q.v.). On attaining his hundredth year he was suitably honored and fêted in London (March, 1905).

Garcia III., 'THE TREMBLER' (958–1001), king of Navarre, sometimes confounded with Garcia II. (d. 970), son of Sancho II., began to reign in 994. He helped to defeat Almansor, general of the caliph of Cordova, at Calatañazor (998). He was the father of Sancho the Great.

Garcia Gutierrez, ANTONIO (1813–84), Spanish dramatist, born at Chiclana, prov. Cadiz. In 1836 he published his first tragedy, *El Trovador*, which was enthusiastically received; this was the literary progenitor of Verdi's better-known opera, *Il Trovatore*. Gutierrez was made director of the archæological museum at Madrid. Among his later dramatic productions are *Simon Bocanegra* (1843); *Juan Lorenzo* (1865), esteemed a masterpiece of modern Spanish drama; and *Venganza Catalana* (1864). Gutierrez also published a collection of lyrical poetry, *Luz y Tinieblas* (2 vols. 1842–61).

Garcia y Iniguez, CALIXTO (1836–98), Cuban soldier and patriot. In 1880 he was in rebellion against the Spaniards. He was captured and deported to Spain, where he suffered fifteen years' imprisonment. After the outbreak of the last rebellion he escaped (1895) to Paris, thence to the United States, and reached Cuba on the *Bermuda*, with field guns and other military supplies. He won several victories over the Spaniards, and in the Spanish-American War led a Cuban force of 4,000 at El Caney (1898). He died while on a mission to Washington shortly afterwards.

Garcilaso de la Vega (*c.* 1540–1616). Spanish-Peruvian historian, self-surnamed 'the Inca,' whose works furnish the chief sources of information concerning the ancient Peruvians. He was born at Cuzco, Peru, about 1540, the son of one of the Spanish conquerors of the country who married a princess of the Incas and a niece of Huayna Capac, the last emperor of Peru. At the age of twenty he left Peru never to return. After a short service in the army under Don John of Austria, he turned to literature, making use of the fund of tradition and information gathered in his youth. His first original work was a history of Florida, containing an account of the conquest of the country by De Soto. In 1609 appeared the first part of his *Royal Commentaries of Peru*, which was published in seventeen volumes shortly after his death at Cordova in 1616. The history was translated in part into English by Sir Paul Rycaut (1688), and another translation by Markham, with notes and an introduction, was published in 1869.

Garcin de Tassy, JOSEPH HÉLIODORE SAGESSE VERTU (1794–1878), French Orientalist, born at Marseilles. He was a pupil of Silvestre de Sacy. He was the founder of, and later president of, the Asiatic Society. Among his numerous works are *L'Islamisme d'après le Coran* (3d ed. 1874); *La Poésie Philosophique et Religieuse chez les Persans* (4th ed. 1864); *Histoire de la Littérature Hindoue et Hindoustani* (1839–47); *Rhétorique et Prosodie des Langues de l'Orient Musulman* (1870–1); *Chrestomathie Hindie et Hindoue* (1849); *La Langue et la Littérature Hindoustanies de* 1850 *à* 1873, an annual review of the literary movements of modern India.

Garcinia, a genus of tropical evergreen trees belonging to the order Guttiferæ. They range between twenty and sixty feet in height, and are not difficult to grow in a peaty soil in stove-houses. They all bear edible fruit, that of the mangosteen (*G. mangostana*) being especially delicate in flavor. Another species is the gamboge (*G. gambogia* or *G. morella*), so called from its cherry-like fruit. Its resinous juice is the source of a purgative and a yellow pigment.

Gard, dep. of S. France, between the Rhone on the E. and the Cévennes Mts. on the W. The area is 2,270 sq. m., and the pop. (1936) 395,299. The department drains from the Cévennes towards the Rhone by the Ardèche, Cèze, and Gardon, and towards the Mediterranean by the Vidourle and the Hérault. All the rivers are subject to sudden and disastrous floods. The chestnut, mulberry, and olive trees and the vine cover large areas; and the department is very rich in minerals (coal, iron, antimony, silver, lead, etc.).

Garda, LAGO DI, Italy, on the N. edge of the plain of Lombardy, between Venice and Milan. It

is 34 miles long by from 3 to 11 miles broad, and in some places 1,900 feet deep. Area, 180 square miles. At its northern extremity, which is in the Austrian Tyrol, it receives the Sarca River, and at its southeastern end it discharges by the Mincio into the River Po. It is the *Lacus Benacus* of Virgil (*Georg.*, ii. 160). The clear waters of the lake abound in fish of various kinds; its surface is studded with many islands. The mild climate and the beauty of its vicinity have caused its shores to be lined with beautiful villas; and the district between Gargnano and Salo, called by the people *Gardone Riviera*, passes for the warmest point in North Italy. The inspiration of its beauties is perpetuated in the poetry of Virgil, Catullus, Dante, Tennyson, Carducci, and others. Consult Countess Cesaresco's *Lombard Studies*.

Gardaia. See GHARDAIA.

Gardariki, gär-dä-rē'kē, both in Scandinavian mythology and in later Viking times, the region to the east of the Baltic Sea, corresponding roughly to the later grand duchy of Novgorod (the Great).

Gardelegen, ancient town, Saxony province, Prussia; 90 miles by rail west of Berlin. It has manufactures of agricultural machinery, buttons, and beer. Pop. 9,000.

Garden, MARY (1877), American soprano, was born in Aberdeen, Scotland, and was brought when a child to the United States. She studied vocal music under Trabadello, Chevallier, and Fugère at Paris; in 1900 made her *début* in Charpentier's *Louise* at the Opéra Comique, scoring a distinct success; and in 1902 created the part of Melisande in Debussy's *Pelléas and Melisande*. Since her first American appearance in *Thaïs* at the Manhattan Opera House, New York, in 1907, and as a member of the Chicago Opera Company since 1910, she has been a warm favorite of the American musical public. Her repertory is largely confined to the modern French operas, in which she is notable for her dramatic ability and remarkable impersonations.

Garden City, city, Kansas, county seat of Finney county, on the Atchison, Topeka, and Santa Fe Railroad; 50 miles northwest of Dodge City. It is the centre of an extensive irrigation system, and a shipping point for cattle and agricultural products, especially beet sugar and alfalfa. Commission government was adopted in 1914. Pop. (1900) 1,590; (1930) 6,121.

Garden City, village, Nassau county, Long Island, New York, on the Long Island Railroad; 20 miles east of New York City. It is the seat of the Protestant Episcopal Cathedral of the Incarnation, a fine Gothic edifice containing an organ valued at $100,000, and of the cathedral schools of St. Paul's and St. Mary's. The publishing works of Doubleday, Page & Co. are located here. The place was founded by the merchant Alexander T. Stewart (q.v.), who laid it out as a model village. Pop. 1,000.

Garden City Movement. See HOUSING REFORM.

Gardener, LION. See GARDINER.

Gardener Bird. See BOWER BIRD.

Gardeners' Garters. See CANARY GRASS.

Garde'nia, a genus of tropical trees and shrubs belonging to the order Rubiaceæ. They have evergreen foliage, and bear beautiful white, fragrant, campanuliform flowers. The fruit is a berry crowned by the calyx. They require a rich soil and an abundance of water in summer; they are usually propagated by cuttings taken in January. Gardenias are peculiarly subject to attacks of green fly and mealy bug.

The *Cape Jasmine* from China, often grown out of doors in the Southern United States, is *Gardenia jasminoides* or *G. florida*. It has fragrant white, waxen, double flowers, resembling the camellia (see JASMINE).

Gardening, or HORTICULTURE. A branch of agriculture in the widest sense of that term, gardening is closely related to the practice of agriculture on the one hand and to the science of botany on the other. For purposes of discussion, however, it may be distinguished from both, the term *agriculture* being limited to farming, or the cultivation of cereal, forage, root, and textile crops and the raising of live stock; the term *botany* to the biology of plants apart from their economic application; and the term *gardening* to the art of growing flowering plants, fruits, or vegetables for use, ornament, or pleasure. It usually implies close cultivation over a somewhat restricted area. It includes Ornamental Gardening, which in turn includes Landscape Gardening (q.v.), Amateur Flower Gardening, and Floriculture (q.v.); Vegetable Raising, whether on a commercial scale or solely for home consumption; and Fruit Raising, though this last is more properly treated under the headings ORCHARDS and FRUIT INDUSTRY.

The essentials of all gardening are soil of a suitable texture, containing available plant food; water to dissolve the plant food, so that the plant rootlets may make use of it; seeds or plants which will produce the desired crops; sunshine and warmth to bring about germination and plant development; and cultivation to conserve the moisture, kill weeds, and incorporate air into the soil. Location and exposure cannot always be considered, especially in gardening small plots, but it should be borne in mind that frost is less likely to injure plants planted on high ground than those planted in low places or valleys into which the heavier cold air commonly settles; that crops will mature more rapidly on land that has a sunny, southern exposure than on other plots; that the garden should be fairly level, but well drained; and that a warm, sandy loam will produce an earlier crop than a heavier soil that retains more water and less heat. A high proportion of humus or rotted vegetable material is desirable in the soil, since it produces an open texture, adds nitrogen, insures the presence of beneficial bacteria, aids in unlocking plant food from mineral particles, and increases the moisture-retaining properties of the soil.

Ornamental Gardening has been practised in Oriental countries from time immemorial; the ancient monuments of Egypt show plans of irrigated gardens as early as 1,600 years B.C.; while the Hanging Gardens (q.v.) of Babylon were counted among the wonders of the world. The Greeks copied their gardening practices from the Persians, when public gardening became a feature of later Greek development; and such gardening as was practised by the Romans closely followed Greek models.

During the Dark Ages practically the only gardening was that carried on by the monks in the growing of medicinal herbs. Later, gardens were formed around the principal castles. Various herbs, shrubs, vegetables, and flowers were grown, and in the more pretentious gardens, arbors, fountains, trimmed hedges, grassy seats, and shade trees were pleasing features. The topiary art, or the pruning of trees or shrubs into fanciful figures, as birds or animals, was known to the Romans, and became a prominent feature of English gardening early in the fifteenth century.

Following the Renaissance came the formal geometrical and architectural style of gardening patronized by the family of the Medici of Italy, and long a model for all Europe. The French style of gardening came into prominence during the reign of Louis XIV., through the celebrated Le Nôtre, who laid out the garden at Versailles. The first greenhouse was also erected at this time by M. Fagon in the *Jardin des*

Plantes. Thenceforth hothouses and orangeries became features of the gardens of the nobility of Northern Europe.

In the formal gardens of England, bowling greens, clipped yews, and sun dials were characteristic features until the eighteenth century, when a reaction set in, and the natural method of gardening came into existence; artificial lakes, streams, and basins were created; and curved driveways, open vistas, and banked masses were employed. This, in its simplified form, is the style of gardening now commonly employed in the United States in public parks and grounds, cemeteries, large estates, and home grounds.

While this form of gardening is properly Landscape Gardening (q.v.), the principles involved are of such fundamental importance that they may be briefly stated, as follows: Keep the centre open; frame and mass the sides; avoid scattered effects. Flowers and high-colored foliage are most effective against a background of green foliage. A flower bed in the middle of a lawn is only a flower bed; against the border it is not only a flower bed, but it may also be a structural part of a picture. Flowers are incidents in a landscape picture. They add emphasis, supply color, give variety and finish; they are the ornaments, but the lawn and the mass plantings make the framework. One flower in the border, serving as a true incident of the picture, is more effective than twenty flowers in the centre of the lawn. More depends upon the position which plants occupy with reference to each other and to the structural design of the garden than upon the intrinsic merits of the plants themselves.

In making a flower garden for the sake of the flowers themselves rather than for the part they play in the general scheme of the grounds or yard, a site at the side or toward the back of the house, with a southern or eastern exposure, is most desirable. After the garden plot has been staked out, a plentiful coating of well-rotted manure should be applied and turned under with a spading fork or a spade. Just before planting the surface should be raked smooth and level.

The time of planting varies. Most annuals will bloom in the latitude of Central New York if the seeds are sown in the open ground when the weather becomes thoroughly settled. They may also be started in hotbeds or in flats in the house, hardened in cold frames, and later transplanted to the garden. Perennials may be raised from seed planted in the spring, the plants being separated into rows in July, and transplanted in the fall; or from roots obtained by dividing the plants in the autumn, the general practice being to divide the plants every second or third year. Certain hardy perennials are also propagated by cuttings (q.v.) set out in the autumn, or kept indoors during the winter and transplanted in the spring.

Spring flowering bulbs, as the crocus, tulip, lily of the valley, hyacinth, narcissus, and snowdrop, should be planted in the fall. The gladiolus, tuberose canna, amaryllis, and other less hardy bulbs should not be put in the ground till after cold weather is over.

Detailed suggestions for planting the commoner annuals and perennials raised from seed are given in the accompanying table.

Rock gardens form a most interesting feature of many large gardens. They are grown on natural ledges of rock, or more frequently on masses of stone artificially placed to simulate natural conditions. The crevices, pockets, and overhanging ledges are filled with earth and planted with Alpine plants (q.v.) and species of small stature from lower altitudes. The alyssums or madworts, anemones, columbine, campanulas, cyclamen, dog's-tooth violet, gentian, forget-me-not, primulas, ferns, heaths, saxifrages, sempivernum, and aubrietia are among the plants most suited to this form of garden.

Water gardens may be made in either natural or artificial lakes, provided a constant supply of fresh water and a means of disposing of surplus water are assured. Two or two and a half feet of water is ample. Nymphæas or water lilies are the most popular plants for the deeper water, while irises may be grown in the shal-

Planting Table for Common Garden Flowers.

Flower.	Time to Plant in Hotbed.	Time to Plant in Open Ground.	Inches Between Rows.	Inches Between Plants.	Depth to Plant Seed (inches).	Season of Blooming.	Remarks.*
Ageratum	March	May	12	6	¼ to ½	June to frost	Hardy. A.
Alyssum		May	12	6	¼ to ½	June to frost	Hardy. A.
Aster	March	May	12	9 to 12	½ to ¾	July to Oct.	Hardy. A. P.
Balsam	April	May	24	24	½ to ¾	July to frost	Tender. A.
Calendula	April	May	12	6	¼ to ½	June to Oct.	Hardy. A.
Campanula	March	April or May	12 to 18	12	¼ to ½	June to Aug.	Hardy. A. P.
Candytuft	April	May	12	4 to 6	¼ to ½	June to Oct.	Half hardy. A.
Centaurea	April	May	18	6	¼ to ½	June to frost	Hardy. A.
Chrysanthemum	March	May	12 to 18	8	½	June to Oct.	Hardy. A.
Cockscomb (low)	April	May	18	12	¼ to ½	June to frost	Hardy. A.
Cockscomb (tall)	April	May	24	24	¼ to ½	June to frost	Hardy. A.
Coreopsis	March	April	18	10	½	June to frost	Hardy. A. P.
Cosmos	April	May	24 to 30	24	½	July on	Hardy. A.
Dahlia	March	May	12 to 18	6	½	Aug. to frost	Half hardy. P.
Dianthus	March	May 1–10	12 to 18	6	¼ to ½	July to frost	Half hardy to hardy. A. P.
Hollyhock	March	July to Sept.	24 to 36	15	½	Aug. on	Hardy. P.
Larkspur	March	May	12	12	¼ to ½	June to Sept.	Hardy. A. P.
Marigold	April	May	12	6	¼ to ½	July to frost	Tender to half hardy. A.
Mignonette	March	May	12	12	¼ to ½	July to frost	Tender to half hardy. A.
Morning glory		April	To climb		½ to ¾	June to frost	Hardy. A.
Nasturtium	April	May	12	12	½ to ¾	June to frost	Half hardy. A.
Pansy	March	April	12	6	¼ to ½	April to frost	Hardy. A.
Petunia	Feb. or March	May	12	12	¼	June to frost	Hardy. A.
Phlox (annual)	March	May	18	12	¼ to ½	June to frost	Hardy. A.
Poppy		April, Sept., Oct.	12	12	¼	June to Aug.	Hardy. A. P.
Salvia	March	May	24	18	¼ to ½	Aug. to frost	Half hardy. P. Hardy. A.
Snapdragon	March	May	12	12	¼ to ½	July to frost	Hardy. P.
Stock	March	May	18	12	¼ to ½	July to Sept.	Hardy. A. B.
Sunflower	April	May	36 to 60	24 or more	1	Aug. to frost	Hardy. A.
Sweet peas		April	36 to 48	Thick	1 to 1½	July to Sept.	Very hardy. A.
Sweetwilliam	March	June	12	6	½ to ¾	June, July	Hardy. A. P.

*A indicates Annual; B biennial; P perennial.

Courtesy Spokane Chamber of Commerce

SUNKEN GARDENS IN SPOKANE, WASHINGTON

Courtesy Fort Worth Chamber of Commerce

BOTANICAL GARDENS AT FORT WORTH, TEXAS

Gardening

lower water or mud, and marsh marigolds, forget-me-nots, water grasses, pitcher plants, hardy orchids, and ferns along the margins.

Window gardens are of two types—the window boxes and porch boxes used out of doors in the summer time, and the winter indoor garden of house plants. For the outdoor garden a stout pine box is used, preferably fitted with a zinc tray to conserve moisture, and filled with a good potting earth. Geraniums, heliotropes, lobelias, tropeolums, Kenilworth ivy, verbenas, sweet alyssum, and petunias are among the plants most used.

The indoor window garden should occupy a window with a southern, southeastern, or eastern exposure, in a room maintained at a fairly uniform temperature. Plants do not thrive in rooms lighted by gas or in overheated apartments. The box or pots should be so arranged that their position can be changed from time to time in order that the plants may receive light from all sides. Among the familiar flowering house plants are the abutilons, browallias, calceolaria, begonias, bouvardias, fuchsias, scarlet sage, calla, heliotrope, Chinese hibiscus, jasmines, petunias, freesias, geraniums, sweet alyssum, oxalis, lobelia, and mesambryantheum. Foliage plants include palms, cannas, ferns, araucarias, vincas, muehlenbeckia, epiphylums, pandanus or screw pine, tradescantia or wandering-jew, English and Kenilworth ivy. Climbing plants are *Asparagus tenuissimus* and *plumosus*, smilax, Madeira vine, Japanese hop, and the parlor ivies. Bulbs of hyacinths, narcissus, tulips, crocus, and other spring-blooming plants, potted in the fall and kept in a cool, shady place from 6 to 8 weeks, may be brought to bloom during the winter months, making an excellent addition to the window garden.

Floriculture, or the cultivation of flowers and decorative plants on a commercial basis, is treated in a separate article (see FLORICULTURE).

Vegetable Gardening.—From its humble beginning in a tiny plot beside the hut of our ancient forefathers, vegetable raising has grown to be one of the leading industries of the world. Primitive means of seed selection, seed sowing, plant selection, and cultivation have gradually been replaced by more exact methods, until the business of gardening has become so highly specialized that many men devote themselves to one class of crops; to a single crop; or even to one variety.

By the exercise of care and forethought in planning succession crops and rotations, and by the utilization of every foot of available space, it is possible to grow considerable quantities of vegetables in a limited area, as in city and suburban back yards or small plots in villages and towns. Important factors are the use of seed boxes, hotbeds, cold frames, and outside seed beds, and the planting of late or succession crops as soon as earlier plants have been removed.

Any sort of wooden box filled with good soil and kept in the house will serve as a seed box. The soil should be pressed down firmly and the seed distributed, 8 or 10 to the inch in rows made, ¼ to ½ inch deep, and about 2 inches apart. The box should be kept in a warm, sunny place, and watered from time to time. When the plants have reached a height of an inch to an inch and a half they should be thinned to one or two inches apart in the row. When the weather becomes mild the box should be set out of doors part of the time, so that the plants will 'harden off' in preparation for transplanting later. Beans, cucumbers, melons, sweet corn, and other warmth-loving plants are frequently started in berry boxes, enough seeds for a hill being planted in each box. When the garden soil becomes warm the bottoms of the boxes are cut away, and the frame and plants sunk in place.

The hotbed is a box-like glass-covered structure which not only collects heat from the sun, but also generates heat of its own from fermentation in fresh manure (see HOTBED). After the heat has reached its maximum and has subsided to between 80° and 90° F., the seeds may be planted. The bed should be kept partially dark until the seeds germinate, but after germination the plants need plenty of light, careful watering, and ventilation. The cold frame, used in hardening plants started in the hotbed, is constructed in much the same manner, except that good potting soil is used instead of manure, and the frame may be covered either with glass sash or canvas. In mild climates the cold frame takes the place of the hotbed for starting plants before seeds can be safely planted in the open.

The seed bed is a small area of the garden in which the gardener starts the second crops while the ground in which they are to develop is still occupied.

For small gardens intended for intensive cultivation the preparation of the soil is of special importance. When possible, ploughing with a team is the best method for giving the ground its initial breaking, especially when it has been firmed by much tramping. Otherwise the earth may be well loosened with the garden fork or spade to a depth of 6 to 10 inches, all lumps being broken up and the soil later pulverized with a steel-tooth rake. Any sod or plant growth should be turned under to rot and form humus. Where the soil is heavy and contains a large proportion of clay, clean sand or well sifted coal ashes may be added for lightening, while a thin coat of air-slaked lime spread on the ground and well worked in will tend both to lighten the soil and to correct acidity.

After the soil has been thus prepared it is usually advisable to apply some form of fertilizer. Barnyard or stable manure, which furnishes both plant food and humus, is undoubtedly the best, being applied on the basis of 20 to 30 tons to the acre, or 400 to 600 pounds for a plot 20 x 20 feet, and later worked in with a hoe and rake. Commercial fertilizers may also be used. (See FERTILIZERS.)

The time for planting vegetables in the open varies with the climate. In general it may be determined by the occurrence of frost. Frost ordinarily will kill tender growths of vegetables, but cabbage, lettuce, potatoes, early peas (smooth seeded), onion seeds and sets, parsnips, salsify, beets, radishes, and such salad plants as kale, spinach, and mustard will survive light frosts. A second group of vegetables including wrinkled peas, carrots, and early sweet corn may be planted as soon as danger of frost is over; string beans and late sweet corn planted a week or ten days later; and cucumbers, melons, squashes, pumpkins, lima beans, and tomato, eggplant, and pepper plants only after the ground has begun to warm up.

Small plants which are to be left almost touching each other, as onions and carrots, are said to be grown in *drills;* plants grown at fixed distances, as cabbages, in *rows;* and plants grown at distances of several feet apart in both directions, as corn, in *hills*. For planting in drills or rows, furrows or shallow trenches are opened with the hoe, rake handle, or similar tool, but hills may be opened with a spade or trowel. Fertilizer applied in the drills, rows, or hills before planting and mixed well with the soil gives good results. The seeds are then sown, forced gently into the earth, and covered immediately. Thick sowings are often made to insure a good stand, and the superfluous plants later pulled up.

If young plants are to be set out they should be watered thoroughly several hours before trans-

Paul's Photos, Chicago

FORMAL GARDEN AT VERSAILLES

Courtesy Metropolitan Museum of Art, New York City

THE ROMAN GARDEN—MODEL IN METROPOLITAN MUSEUM OF ART, NEW YORK

planting, lifted out of the hotbed or cold frame with a trowel, keeping as much soil as possible on the roots, and inserted into a hole opened with a trowel or dibble. The soil is then drawn up to the stalk and firmed with the knuckle or ball of the thumb. In dry soil about a pint of water should be poured into each hole before the plant is set. The surface about each plant should be raked carefully when all the plants are set. Transplanting should be done in cloudy weather or late in the afternoon, if possible, and the young plants should be shaded with newspapers for a few days if the sun is bright.

Detailed suggestions for planting are given in the accompanying table, from *Farmer's Bulletin No. 818*, issued by the U. S. Department of Agriculture.

After the seeds have sprouted or the young plants have been set in their permanent locations, repeated stirring of the soil with hand tools or a wheel cultivator should be practised between the rows and about the plants. The soil should be kept clear of weeds, and spraying and other protective measures should be practised to combat insect pests (see INSECTICIDES). During prolonged dry spells, water should be supplied artificially by sprinkling or some other method of irrigation. This should be done very early in the morning or after sundown.

Since a number of vegetables mature early in the season, it is possible to utilize the space occupied by these for successive plantings of the same vegetable or for rotation plantings of different plants. Thus successive crops may be grown of radishes, spinach, lettuce, peas, parsley, dwarf beans, turnips, and kohlrabi, or these may follow or be followed by other crops. Crops which may be succeeded by later ones are onion sets and early varieties of beets, turnips, carrots, corn, and cabbage; others which may follow earlier ones are late beets, late peas, celery, Brussels sprouts, late cabbage, cauliflower, kale, endive, and flat turnips. Asparagus, rhubarb, pole beans, late carrots, parsnips, salsify, late corn, cucumbers, melons, squash, pumpkins, tomatoes, eggplant, peppers, onions grown from seed, leeks, okra, potatoes, and rutabagas occupy the ground all season.

Market and Truck Gardening.—Near all the large cities and towns, vegetables are extensively grown and marketed by the producers—a method of farming known as market gardening. Farther from markets are those wide areas in specially favored regions where truck farming or the raising of vegetables for long-distance shipment and distribution to the smaller markets is carried on.

The chief truck-gardening regions of the United States have become such because they are specially adapted on account of soil, climate, and easy access by rail or by boat to the principal cities, for raising and shipping fruits and vegetables. Thus California ships celery and fresh fruits to New York markets; Colorado ships muskmelons all over the country; Texas and the other Gulf States send large quantities of vegetables north before northern grown stuff can be put on the market. Mississippi, Tennessee, and Kentucky have become noted for the production of strawberries; Norfolk, Va., ships enormous quantities of early fruits and vegetables north; and early vegetables are grown in the extreme south of Florida.

Gardening Under Glass.—The growing of vegetables and flowers under glass in winter is an important industry in many Northern States in the vicinity of the larger cities and towns. The chief vegetables grown are lettuce, tomatoes, radishes and cucumbers, though minor crops, like beans and melons, are also raised. Fruits are not grown under glass to any considerable extent in the United States, but flowers are extensively grown (SEE FORCING; GREENHOUSE.)

School Gardens are flower and vegetable gardens used for educational purposes in connection with the schools. The garden may be divided into plots, each of which is assigned for a season to an individual pupil, who plants it, cares for it, and has absolute control of the produce; it may be conducted under the community system, all the pupils co-operating in its care and the produce being used for a common purpose; or the two methods may be combined, individual vegetable gardening being supplemented by group responsibility for flower beds, for plots devoted to exotic plants grown for observational purposes, and for the care of paths.

The educational significance of school gardening as conducted in the United States is probably rather cultural than vocational. Some of its chief benefits lie in the fact that it provides exercise in the open air; teaches the child the elements of nature study, and introduces him to the joy of productive effort; trains him in the use of his eyes and hands, and in the care and use of tools; develops patience, observation, and method; and furnishes a useful outlet for the play instinct.

War Gardens.—The readiness with which gardening lends itself to public service was well attested in the War-Garden Movement in the United States. The motto, 'Food will win the war,' provided the text; thousands of vacant lots and little-used pieces of land supplied the means; and patriotism the incentive. The production of great quantities of food materials was the immediate result, with consequent saving of coal and cargo space in transportation. The educational results were important, and have persisted since the war. The campaign popularized gardening, utilized waste lands, and contributed to the independence of the people. Statistics released by the National War Garden Commission for 1918 revealed a total of 5,285,000 'war gardens' with an estimated value of the product exceeding $350,000,000.

Suburban Gardening.—After 1918, there was an increasing movement of city dwellers toward the suburbs, a tendency motivated to a large extent by the desire for more healthful living conditions. As a result, innumerable vegetable gardens came into being, both as hobbies and as means to maintaining more scientific diets (vegetables form an important source of at least four vitamins). Among other benefits that were derived from such gardens were exercise, reduced cost of living, and first hand information about horticultural practices.

Aquaculture. — Though far from perfected, tank gardening, or aquaculture, has been the most important horticultural development since 1930. Based on the theory that the only requirements of plant life are moisture, sunshine, and chemical plant food, the new method of gardening is carried on entirely without the help of Mother Earth. Equipment usually consists of a large vat of water (containing phosphorus, nitrogen, etc., in dissolved form), a mesh of wire slightly above the liquid and a straw mulch for supporting the seedlings. As the plants grow and produce, additional elements are fed into the water to provide for constant growth. Tests have proved that this type of gardening, properly supervised, far outyields a similar amount of ordinary garden. One of the most important practical applications of aquaculture was made in the Wake Islands in 1939 with the installation of a seventy foot tank for year-round culture of chemically nurtured lima beans, tomatoes, and cucumbers, under the expert supervision of a California biologist. The island was thus made independent of previous sources of supply 5,000 miles away.

In connection with the subject of Gardening see the article on AGRICULTURE and the cross references there cited; also PLANTS;

Courtesy Tacoma Chamber of Commerce

HOME GARDEN IN WASHINGTON

Courtesy The Victoria and Island Publicity Bureau

SUNKEN GARDEN OF A BRITISH COLUMBIA HOME

GARDENER'S PLANTING TABLE.

Kind of vegetable.	Rows apart for horse cultivation.	Rows apart for hand cultivation.	Plants apart in rows.	Depth of planting.	Time of planting in open ground in South.	Time of planting in open ground in North.	Ready for use after planting.
Artichoke, globe	3 to 4 ft.	2 to 3 ft.	2 to 3 ft.	1 to 2 in.	Spring	Spring	15 months.
Artichoke, Jerusalem	3 to 4 ft.	1 to 2 ft.	1 to 2 ft.	2 to 3 in.	Spring	Spring	6 to 8 months.
Asparagus, seed	30 to 36 in.	1 to 2 ft.	3 to 5 in.	1 to 2 in.	Autumn or early spring	Early spring	3 to 4 years.
Asparagus, plants	3 to 5 ft.	12 to 24 in.	15 to 20 in.	3 to 5 in.	Autumn or early spring	Early spring	1 to 3 years.
Beans, bush	30 to 36 in.	18 to 24 in.	5 or 8 to ft.	½ to 2 in.	February to April. [Aug. to Sept.]	April to July	40 to 65 days.
Beans, pole	3 to 4 ft.	3 to 4 ft.	3 to 4 ft.	1 to 2 in.	Late spring	May and June	50 to 80 days.
Beets	24 to 36 in.	12 to 18 in.	5 or 6 to ft.	1 to 2 in.	February to April. [Aug. to Sept.]	April to August	60 to 80 days.
Brussels sprouts	30 to 36 in.	24 to 30 in.	16 to 24 in.	½ in.	January to July	May and June	90 to 120 days.
Cabbage, early	30 to 36 in.	24 to 30 in.	12 to 18 in.	½ in.	October to December	March and April. (Start in hotbed during February.)	90 to 130 days.
Cabbage, late	30 to 40 in.	24 to 36 in.	16 to 24 in.	½ in.	June and July	May and June	90 to 130 days.
Cardoon	3 ft.	2 ft.	12 to 18 in.	1 to 2 in.	Early spring	April and May	5 to 6 months.
Carrot	30 to 36 in.	18 to 24 in.	6 or 7 to ft.	½ in.	March and April. [September]	April to June	75 to 110 days.
Cauliflower	30 to 36 in.	24 to 30 in.	14 to 18 in.	½ in	January and February. [June.]	April to June. (Start in hotbed during February or March.)	100 to 130 days.
Celery	3 to 6 ft.	18 to 36 in.	4 to 8 in.	¼ in.	August to October	May and June. (Start in hotbed or cold frame in March or April.)	120 to 150 days.
Chervil	30 to 36 in.	18 to 24 in.	3 or 4 to ft.	1in.	Autumn	Autumn	1 year.
Corn, sweet	36 to 42 in.	30 to 36 in.	30 to 36 in.	1 to 2 in.	February to April	May to July	60 to 100 days.
Cress, water	Broadcast.			On surface	Early spring	April to September	60 to 70 days.
Cucumber	4 to 6 ft.	4 to 6 ft.	4 to 6 ft.	1 to 2 in.	February and March. [September.]	April to July	60 to 80 days.
Eggplant	30 to 36 in.	24 to 30 in.	18 to 24 in.	½ to 1 in.	February to April	April and May. (Start in hotbed during March.)	010 to 140 days.
Endive	30 in.	18 in.	8 to 12 in.	½ to 1 in.	February to April	April. [July]	90 to 180 days.
Horse-radish	30 to 40 in.	24 to 30 in.	14 to 20 in.	3 to 4 in.	Early spring	Early spring	1 to 2 years.
Kale, or borecole	30 to 36 in.	18 to 24 in.	18 to 24 in.	½ in.	October to February	August and September. [March and April.]	90 to 120 days.
Kohl-rabi	30 to 36 in.	18 to 24 in.	4 to 8 in.	½ in.	September to March	March to May	60 to 80 days.
Leek	30 to 36 in.	14 to 20 in.	4 to 8 in.	1 in.	May to September	March to May	120 to 180 days.
Lettuce	30 in.	12 to 18 in.	4 to 6 in.	½ in.	September to March	March to September	60 to 90 days.
Melon, muskmelon	6 to 8 ft.	6 to 8 ft.	Hills 6 ft.	1 to 2 in.	February to April	April to June. (Start early plants in hotbed during March.)	120 to 150 days.
Melon, watermelon	8 to 12 ft.	8 to 12 ft.	Hills 10 ft.	1 to 2 in.	March to May	May and June	100 to 120 days.
Okra, or gumbo	4 to 5 ft.	3 to 4 ft.	24 to 30 in.	1 to 2 in.	February to April	May and June	90 to 140 days.
Onion, seed	24 to 36 in.	12 to 18 in.	4 or 5 to ft.	½ to 1 in.	October to March	April and May	130 to 150 days.
Onion, sets	24 to 36 in.	12 to 18 in.	4 or 5 to ft.	1 to 2 in.	Early spring	Autumn and February to May	90 to 120 days.
Parsley	24 to 36 in.	12 to 18 in.	3 to 6 in.	½ in.	September to May	September and early spring	90 to 120 days.
Parsnip	30 to 36 in.	18 to 24 in.	5 or 6 to ft.	½ to 1 in.		April and May	125 to 160 days.
Peas	3 to 4 ft.	30 to 36 in.	5 or 6 to ft.	2 to 3 in.	September to April	March to June	40 to 80 days.
Pepper	30 to 36 in.	18 to 24 in.	15 to 18. in	½ in.	Early spring	May and June. (Start early plants in hotbed during March.)	100 to 140 days.
Potato, Irish	30 to 36 in.	24 to 36 in.	14 to 18 in.	4 in.	January to April	March to June	80 to 140 days.
Potato, sweet	3 to 5 ft.	3 to 5 ft.	14 in.	3 in.	April and May	May and June. (Start plants in hotbed during April.)	140 to 160 days.
Pumpkin	8 to 12 ft.	8 to 12 ft.	Hill 8to12ft	1 to 2 in.	April and May	May to July	100 to 140 days.
Radish	24 to 36 in.	12 to 18 in.	8 to ft.	½ to 1 in.	September to April	March to September	20 to 40 days.
Rhubarb, seed	36 in.	30 to 36 in.	6 to 8 in.	½ to 1 in.		Early spring	2 to 4 years.
Rhubarb, plants	3 to 5 ft.	3 to 5 ft.	3 ft.	2 to 3 in.		Autumn or early spring	1 to 3 years.
Rutabaga	30 to 36 in.	18 to 24 in.	6 to 8 in.	½ to 1 in.	August and September	May and June	60 to 80 days.
Salsify	30 to 36 in.	18 to 24 in.	2 to 4 in.	½ to 1 in.		Early spring	120 to 180 days.
Spinach	30 to 36 in.	12 to 18 in.	7 or 8 to ft.	1 to 2 in.	September to February	September or very early spring	30 to 60 days.
Squash, bush	3 to 4 ft.	3 to 4 ft.	Hills 3to4ft.	1 to 2 in.	Spring	April to June	60 to 80 days.
Squash, late	7 to 10 ft.	7 to 10 ft.	Hills 7to9ft	1 to 2 in.	Spring	April to June	120 to 160 days.
Tomato	3 to 5 ft.	3 to 4 ft.	3 ft.	½ to 1 in.	December to March	May and June. (Start plants in hotbed during Feb. and March.)	100 to 140 days.
Turnip	24 to 36 in.	18 to 24 in.	6 or 7 to ft.	¼ to ½ in.	August to October	April. [July]	60 to 80 days.
Vegetable marrow	8 to 12 ft.	8 to 12 ft.	Hills 8to9ft.	1 to 2 in.	Spring	April to June	110 to 140 days.

[Brackets indicate that a late or second crop may be planted the same season.]

Gardening

Courtesy Rock Island Lines

CATHEDRAL SPIRES IN GARDEN OF THE GODS

Vertically tilted beds of red Permian sandstone have been eroded by the weather, leaving these remnants standing in grotesque forms.

Courtesy C. & N. W. Ry. Co.

GATEWAY TO THE GARDEN OF THE GODS

BULB; CUTTINGS; ELECTROCULTURE OF PLANTS; FLORICULTURE; FORCING; GRAFTING; GREENHOUSE; HOTHOUSE; LAWNS; PRUNING; SHRUBS; TRANSPLANTING; TREE SURGERY; and the separate articles on the various plants, vegetables, and fruits.

Bibliography.—Farmer's Bulletins: *Growing Annual Flowering Plants* (1939); *Herbaceous Perennials* (1929); *City Home Garden* (1938); *Hotbeds and Coldframes* (1935); *Farm Garden* (1936); *Diseases and Insects of Garden Vegetables* (1937); Ag. Circ. 487: *Selecting Fertilizers* (1938); Ag. Misc. Publ. 275: *Vitamin Content of Foods* (1937) and many other Government publications on gardens.

Garden of the Gods, a tract of 480 acres noted for its great scenic beauty, 5 miles north of Colorado Springs, Col. It has many cliffs and crags of red and white sandstone, of weird and grotesque shapes. The chief features include the Gateway, two masses of red rock more than 300 feet high with only sufficient space between them at the bottom to admit a wagon; the Cathedral Spires; the Balanced Rock; the Seal and Bear, etc. The Garden affords a fine view of Pike's Peak. It was presented to Colorado Springs by its owners, the children and heirs of Charles E. Perkins, and the gift was accepted by the city on Dec. 24, 1909.

Gardens of Adonis. See ADONIS GARDENS.

Garden Warbler (*Sylvia hortensis*), a European warbler of the same genus as the blackcap and the whitethroat. It is olive brown above, and paler below. See BLACKCAP; WHITETHROAT.

Gardiner, gärd'ner, city, Kennebec county, Maine, on the Kennebec River, the Maine Central Railroad, and the Eastern Steamship Company's line from Boston; 6 miles south of Augusta. The manufactures include lumber, paper, and pulp mills, shoe factories, foundries and machine shops, and electric railway supplies. The ice industry is important in winter. Gardiner was settled in 1760, and was part of Pittston until 1803. Commission government was adopted in 1912. Pop. (1900) 5,501; (1930) 5,609.

Gardiner, JAMES (1688–1745), Scottish soldier, was born in Carriden, Linlithgowshire. In 1702 he joined the English army, and fought under Marlborough at Blenheim (1704) and at Ramillies (1706). Ten years later he headed a storming party at the Battle of Preston, and became a major in 1718. From an early period Gardiner was noted for his licentiousness; but in 1719 a vision of Christ on the cross transformed him into a pious and exemplary Christian. In 1745, at the Battle of Prestonpans, he met a soldier's death.

Gardiner, or GARDENER, LION (1579–1663), English settler, came to America as an engineer in 1635 to plan a town and fort (called Saybrook) for the company owning the tract of land at the mouth of the Connecticut River. In 1639 he purchased from the Indians a small island off the coast of Long Island which he named Isle of Wight, and which is now Gardiner's Island (q.v.). This was the first English settlement within the present boundaries of New York State. He was granted full proprietary and baronial rights over the island, and succeeded in entailing it for nine generations. Consult C. C. Gardiner's *Lion Gardiner and His Descendants.*

Gardiner, SAMUEL RAWSON (1829–1902), English historian, was born in Ropley, Hampshire. He was for some time lecturer on history at King's College, London, but after his election to an All Souls fellowship at Oxford (1884) devoted his energies to historical research. His principal work is practically a history of England from the accession of James I. to the end of the protectorate of Oliver Cromwell, but only one chapter of the last volume has been completed. Gardiner was an impartial, painstaking writer, who brought to light much fresh information regarding the period he treated. The chief sections of his great work were *History of England from the Accession of James I. to the Outbreak of the Civil War* (10 vols., new ed. 1883–4); *History of the Great Civil War* (4 vols., new ed. 1893); *History of the Commonwealth and Protectorate* (3 vols., new ed. 1894–1903). In addition to these, he published: *Prince Charles and the Spanish Marriage* (1869); *Oliver Cromwell* (1901); *What the Gunpowder Plot Was* (1897); *The Thirty Years' War* (1874); *Constitutional Documents of the Puritan Revolution* (1889; 2d ed. 1899). From 1891 to 1901 he edited the *Historical Magazine.*

Gardiner, STEPHEN (1483–1555), English diplomat, bishop of Winchester, was born at Bury St. Edmunds, and became secretary to Cardinal Wolsey. Sent as ambassador to Pope Clement VII. (1528), he obtained a second commission on the royal divorce question, thereby winning the favor of Henry VIII. Consecrated bishop of Winchester (1531), and employed on embassies to France and Rome (1531–2), he supported the divorce on national grounds. He did his share in the translation of the New Testament (1535); and Burnet's charge against him of having prevented the new translation (1542) has been amply refuted by Dixon (*Hist. of Church of England,* ii. 285–289). Having celebrated mass at Henry's obsequies, Gardiner was ousted from the council and the chancellorship of Cambridge, deprived of his see, and imprisoned in the Tower throughout Edward VI.'s reign. Liberated by Mary and made lord chancellor, he opposed the Spanish marriage, and advocated an English consort for the Queen. In the Marian persecutions he practically took no part, declaring strongly against them after the Calais conferences (1555). His endeavors to save the lives of Cranmer and Northumberland are now admitted. Gardiner died in communion with Rome.

Gardiner, SYLVESTER (1707–86), American physician, was born in South Kingston, R. I., and after a medical course in London and Paris, settled in Boston, where he introduced into this country the practice of inoculation. He was one of the first colonizers along the Kennebec River, in Maine, where the present town of Gardiner was named in his honor. He sustained the course of Hutchinson, the royal governor of Massachusetts, in 1774, and became an active loyalist, leaving Boston for Halifax with the British army in 1776. He later resided in England, and his property, to the extent of 100,000 acres, was confiscated. In 1785 he returned to the United States, and settled in Newport, R. I.

Gardiner's Island, at the eastern entrance of Long Island Sound, Suffolk county, New York, in the bay between Orient and Montauk Points, 5 miles from the mainland. Area, 3,300 acres. The island has been in the possession of the Gardiner family since it was purchased by Lion Gardiner (q.v.). Treasure discovered here was supposed to have been buried by Captain Kidd.

Gardner, town, Worcester county, Massachusetts, on the Boston and Maine Railroad; 10 miles west of Fitchburg, and 50 miles northwest of Boston. Educational and philanthropic institutions include the Henry Heywood Memorial Library and Museum, Henry Heywood Memorial Hospital, and the State Colony for the Insane. It is one of the leading places in the manufacture of chairs; other industries include the manufacture of toys, baby carriages, furniture, silverware, cigars, machinery, oil stoves, time recorders, steam heaters, harness, and concrete blocks. The U. S. Census of Manufactures for 1929 reported 76 establishments, with 4,295 wage earners (yearly average), and products valued at $19,348,-

877. It was first incorporated in 1785. Pop. (1900) 10,813; (1910) 14,699; (1930) 19,399.

Gardner, ERNEST ARTHUR (1862–), English archæologist, Yates professor of archæology, University College, London, was born in London. He was engaged in 1885–6 in exploring Naucratis, a Greek settlement in Egypt, of the 7th century B. C., and wrote the chapter on inscriptions in *Naukratis I.* (1886), and the memoir *Naukratis II.* (1888), published by the Egypt Exploration Fund. From 1887 to 1895 he was director of the British School of Archæology at Athens. He became joint-editor of the *Journal of Hellenic Studies* in 1897, and wrote *A Handbook of Greek Sculpture* (1896–7; revised 1915), *Ancient Athens* (1902), *Six Greek Sculptors* (1910), and *Religion and Art in Ancient Greece* (1910).

Gardner, PERCY (1846–), English numismatist and archæologist, was born at Hackney, London. He was educated at the City of London School and at Christ's College, Cambridge, and in 1887 was called to the chair of classical archæology at Oxford. His numerous publications include *Samos and Samian Coins* (1882); *The Types of Greek Coins* (1883); *New Chapters in Greek History* (1892); *Sculptured Tombs of Hellas* (1896); *Exploratio Evangelica* (1899); *Historic View of the New Testament* (1901); *Oxford at the Cross Roads* (1903); *The Growth of Christianity* (1907); *Religious Experience of St. Paul* (1911); *Principles of Greek Art* (1913); *The Ephesian Gospel* (1915); *History of Ancient Coinage* (1918); *Practical Basis of Christian Belief* (1923).

Gare Fowl or Great Auk

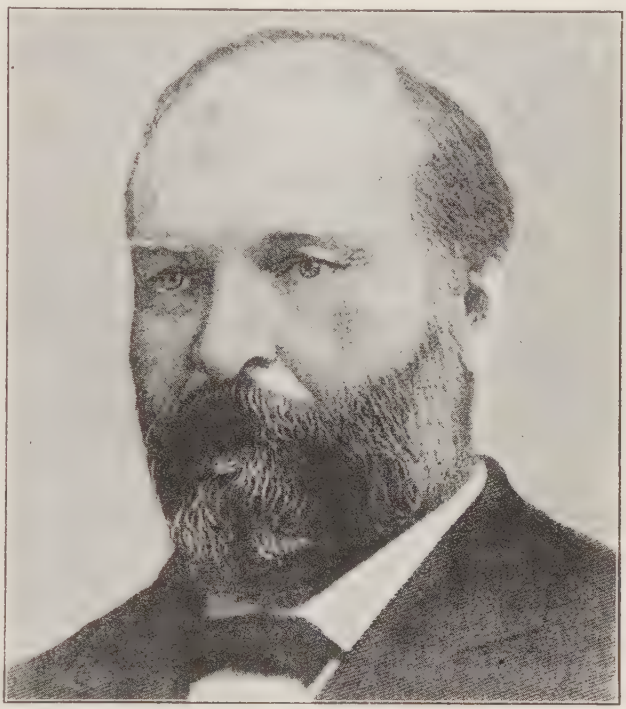
Gardner Gun, an early type of machine gun. See GUNS.

Gardone Riviera. See GARDA, LAGO DI.

Gare-fowl, gâr'foul, or GREAT AUK (*Plautus impennis*), a flightless member of the bird family Alcidæ, which inhabited the northern hemisphere, and was exterminated about 1844. Owing to the shortness of the wings, the birds, although admirable swimmers, were incapable of flight. The most famous breeding-places were three islets off Iceland, and Funk Island, near Newfoundland. On Funk Island they were driven into 'pounds' constructed of stone, and slaughtered like sheep. The breeding-places near Iceland were destroyed by a volcanic outburst. The gare-fowl reached a length of thirty-two inches. The bill was as long as the head, and was grooved. The plumage was black above and white beneath, with a characteristic white spot in front of the eye. The history of the extermination of this great waterfowl is given in the Smithsonian Report for 1888.

Gar'field, city, New Jersey, Bergen county, on the Passaic River and the Erie Railroad; 10 miles northwest of New York City. It has woollen and knitting mills, embroidery and stone works, and manufactures of clothing, boxes, rubber, paper, and chemicals. According to the Federal Census for 1937, industrial establishments number 56, with 6,199 wage earners, and products valued at $28,034,895. Pop. (1910) 10,213; (1920) 19,381; (1940) 27,988.

Garfield, HARRY AUGUSTUS (1863–), American educator, son of President Garfield, was born in Hiram, Ohio. He was graduated from Williams College in 1885, and afterward studied at Princeton, Dartmouth, Amherst, Wesleyan, and William and Mary Universities. He pursued graduate study, chiefly law, in Columbia, Oxford, and the Inns of Court, London. He practiced law in Cleveland, Ohio, in 1888–93, was professor of politics in Princeton University (1903–08), and in 1908 became president of Williams College. He was appointed U. S. fuel administrator by President Wilson in 1917.



Publishers' Photo Service.

James Abram Garfield.

Garfield, JAMES ABRAM (1831–81), American statesman, twentieth president of the United States, was born on Nov. 19, 1831, in Orange, Cuyahoga county, Ohio. He was the son of Abram Garfield, a farmer, and passed his boyhood on a farm, receiving little systematic schooling. His early life was a hard struggle with poverty. At seventeen he went to Cleveland, and for a short time worked on a canal

boat and afterward as a carpenter. He studied at a seminary in Chester, O., and at the Hiram (O.) Eclectic Institute, and in 1854 entered Williams College, from which he was graduated in 1856. Immediately afterward he became professor of ancient languages and literature in the Hiram Eclectic Institute, serving as its president in 1857–61. Thoroughly opposed to slavery, he soon entered politics as a Republican, and in 1859–61 was a member of the Ohio senate.

During the Civil War he served with distinction in the army, rising from the rank of lieutenant colonel of volunteers (commissioned Aug. 21, 1861) to that of major general of volunteers (commissioned Sept. 19, 1863), and particularly distinguishing himself at Shiloh and at Chickamauga, where he was Gen. Rosecrans' chief of staff. In December, 1863, he resigned his commission, and from 1863 until 1881 was a Republican representative in Congress. As chairman of the committee on military affairs he rendered valuable services during the latter part of the war, and he was later chairman in turn of the committee on banking and of the committee on appropriations. He took an influential part in the debates concerning the reconstruction of the Southern States, and advocated the impeachment of President Johnson. He was also prominent in various debates concerning taxation and the currency.

Garfield's reputation, however, suffered greatly as a result of charges brought against him in connection with the Crédit Mobilier scandal (see CRÉDIT MOBILIER OF AMERICA) to the effect that he had corruptly received from Oakes Ames the sum of $329. The charge of corruption was never proved against him; but in 1880, when he was a candidate for the presidency, it was revived by his opponents, and the figures '329' were used as a campaign cry and were chalked on walls, buildings, and pavements all over the country. In 1877 Garfield was a member of the Electoral Commission, and in 1880 he was elected to the U. S. Senate, but before he could take his seat he was nominated for the presidency, as a Republican compromise candidate, and in November, 1880, was elected, receiving 214 electoral votes, while Hancock, his Democratic opponent, received only 155. Immediately after his inauguration he came into conflict with the Republican faction in New York known as the 'Stalwarts' (see STALWARTS, and CONKLING, ROSCOE), on the question of patronage. On July 2, 1881, he was shot by a fanatic, Charles Jules Guiteau, who had applied in vain to the President for an office and who is supposed to have been influenced by the bitter and intemperate attacks made upon President Garfield by his 'Stalwart' opponents. The President was taken to Elberon, N. J., where he died on Sept. 19. Consult Ridpath's *Life and Work of James A. Garfield.*

Garfield, JAMES RUDOLPH (1865–), American public official, son of President James A. Garfield, was born in Hiram, O. He was educated at St. Paul's school, Concord, N. H., and at Williams College, from which he was graduated in 1885. From 1896 to 1899 he was a member of the Ohio State senate. He was subsequently a member of the U. S. Civil Service Commission, and in March, 1903, was appointed Commissioner of Corporations in the Department of Commerce and Labor. Early in 1905 he made a report calling attention to the importance of the problems arising out of commercial and industrial conditions, the liability to abuse, and the consequent necessity of a Federal franchise or license for engaging in interstate commerce, whereby corporations might be forced to obey the laws. In 1905 and 1906 he made important reports on the 'Beef Trust,' and the Standard Oil Trust, and in 1907–1909 was Secretary of the Interior in President Roosevelt's cabinet. Since that time he has practised law in Cleveland, Ohio. See TRUSTS.

Garfish. See GAR.

Gargantua. See RABELAIS.

Gargoyle, gär'goil, in Gothic architecture the name given to a spout projecting from the gutter of a building, in order to carry the rain-water clear of the walls. Gargoyles are usually carved into different forms—animal, human, or grotesque, and are an interesting feature in ecclesiastical architecture.

Garibaldi, gä-rē-bäl'dē, GIUSEPPE (1807–82), Italian patriot and guerilla leader, was born in Nice. He early became associated with Mazzini's movement for Italian liberty, and in consequence was forced to flee the country (1834). After various adventures he entered the service of the revolted Brazilian state of Rio Grande (1836), and then of the republic of Monte Video (1842-6). In 1848 he returned to Italy, leading a body of volunteers against the Austrians. Thence he went to Rome, then in the hands of the patriots, and besieged by the French, and materially assisted in its defence. The breakdown of the popular movement sent him again upon his travels. He went to the United States and lived for a time in Staten Island, N. Y., and after another visit to South America, took command of an American trading-vessel on the Pacific coast. In 1854 he settled on a small farm in the island of Caprera (northeast of Sardinia), whence he eagerly awaited the issue of Cavour's policy in Italy. After fighting in the Sardinian cause against Austria in 1859, the following year he protested against the cession of Nice and Savoy, which Napoleon III. had exacted from Cavour. In this same year he sailed from Genoa with the famous 'thousand volunteers,' and on May 11, 1860, landed at Marsala in Sicily, routed at Calatafimi a much larger body of troops sent against him, and within twenty-six days from landing made himself master of Palermo. In two months he was at the head of 18,000 men, and on July 28 the Neapolitans evacuated Messina, leaving him absolute master of the island. Between August 9 and 19 Garibaldi crossed to the mainland, and his progress towards the capital (Naples) was a triumphal procession.

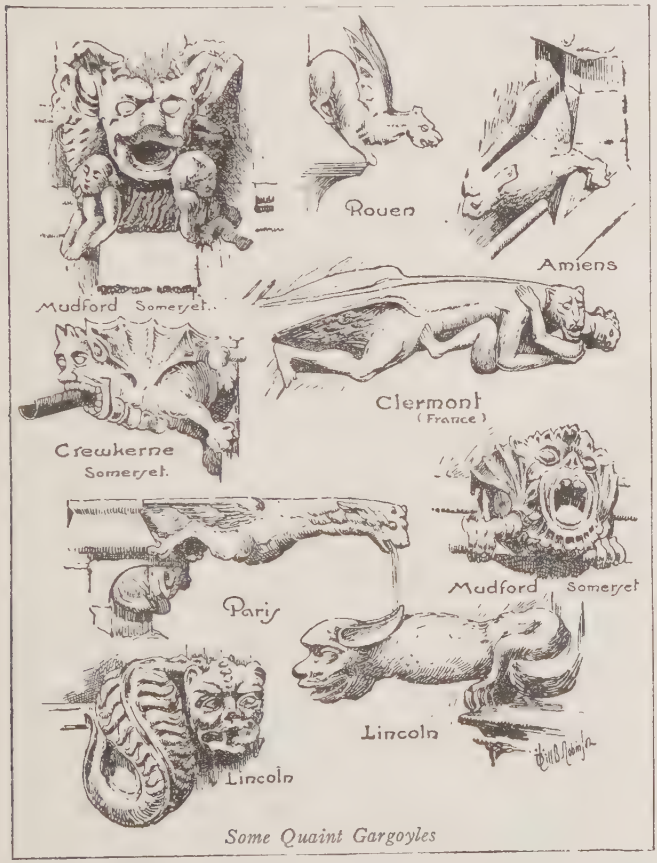
Meanwhile Cavour, disliking the republicanism to which Garibaldi was inclined, endeavored to get possession of Naples before Garibaldi reached it; but Garibaldi was too quick for him, and entered the city on September 7. When, however, the Sardinian army of Victor Emmanuel appeared on the Neapolitan frontier, Garibaldi resigned his dictatorship and on Nov. 9, 1860, retired to Caprera. Still lured, however, by the dream of a united Italy, with Rome as its capital, he twice again called his volunteers to the task. The first time he was severely wounded in a battle against the royal troops at Aspromonte (1862); and on the second attempt he met with a severe defeat from the papal and French troops at Mentana, near Rome, and was taken prisoner by the Sardinian government (Nov., 1867), and confined for some days near Spezia, whence he was permitted to retire once more to Caprera. His only other public act was his rather quixotic attempt to aid the infant French republic against the Germans in 1870–1, when he headed a corps of French volunteers in Burgundy. His campaigning was unsuccessful, and he felt bitterly the criticisms to which the French subjected him. Consult Marriott's *The Makers of Modern Italy;* Bent's *Life of Garibaldi;* Marlo's *Garibaldi e i suoi Tempe;* Melena's *Garibaldi.*

Garlep. See ORANGE RIVER.

Garigliano, gä-rēl-yä'nō (anc. *Liris*), river of Southern Italy, rises on the borders of Abruzzi, and flows for about 100 miles to the Gulf of Gaeta, on the Mediterranean. Near here, in December, 1503, the French were defeated by the Spaniards under Gonsalvo de Cordova. Here the Chevaler Bayard made his famous defence of the bridge over the river.

Gar'land, AUGUSTUS HILL (1832–99), American public official, was born in Tipton County, Tenn., but soon after removed with his parents to Arkansas. He received his education at St. Mary's College, Lebanon, Ky., and St. Joseph's College, Bardstown, Ky., and was admitted to the Arkansas bar in 1853. Although he opposed the secession of the State, he joined the Southern cause and was elected to the Confederate congress and afterwards to its senate, where he remained until the close of the war. He made a successful protest before the U. S. Supreme Court against making the 'iron-clad oath' a necessity for resuming the practice of law. In 1874 he was elected governor of Arkansas by a large majority, and in 1877 entered the U. S. Senate. He was re-elected in 1883, and in 1885 was appointed by President Cleveland attorney general of the United States. After his retirement in 1889 he practised law in Washington.

Garland, HAMLIN (1860-1940), American author, was born in West Salem, Wis. He was educated at Cedar Valley Seminary, Osage, Ia., taught school in Illinois (1882–3) and in 1884 went to Boston and began his literary career. His first book, *Main Travelled Roads* (1890), was a volume of short stories, and he has since devoted himself principally to fiction of a realistic type. His work presents some forceful pictures of the development of the Middle West. He is a member and one of the Directors of the American Academy of Arts and Letters. Among his books are *A Little Norsk* (1891), *Prairie Folks* (1892), *A Spoil of Office* (1892), *Prairie Songs* (1894), *Crumbling Idols* (essays, 1893), *Wayside Courtships* (1897), *Ulysses S. Grant* (biography, 1898), *Her Mountain Lover* (1901), *The Captain of the Gray-Horse Troop* (1902), *Hesper* (1903), *Light of the Star* (1904), *The Tyranny of the Dark* (1905), *The Long Trail* (1907), *Money Magic* (1907), *Boy Life on the Prairie* (1907), *The Shadow World* (1908), *Other Main Travelled Roads* (1913), *A Son of the Middle Border* (1917), *A Daughter of the Middle Border* (1921), *The Book of the American Indian* (1923), *The Trail Makers* (1926).



Some Quaint Gargoyles

Gar'lic (*Allium sativam*), an onion-like plant of strong flavor. It is a perennial and grows wild in the south of Europe, but is now commonly cultivated in nearly every country. The plant has a pungent acrid taste and a penetrating and offensive odor. The bulb, which is the part usually eaten, consists of some 12 or 15 ovate subordinate bulbs. Oil of garlic occurs naturally in the common garlic, and is obtained by bruising the bulbs, digesting in water, and distilling in steam. It can also be prepared artificially. It is used in medicine as a stimulant, diuretic, and irritant.

Garman, CHARLES EDWARD (1850–1907), American educator, was born in Limington, Me. He was graduated (1872) from Amherst, and from the Yale divinity school in 1879. In 1880 he was appointed instructor in mathematics at Amherst, in 1881 became instructor in philosophy, was associate professor of mental and moral philosophy in 1882, and full professor in 1892.

Garman, SAMUEL (1843–1927), American naturalist, born in Indiana County, Pa. He was graduated from the Illinois State Normal University in 1870 and in 1873 became assistant in herpetology and ichthyology at the Harvard University Museum. His publications include *Fishes and Reptiles from Lake Titicaca* (Bul. of the Museum, vol. iii., 1871–6, No. 11); *The Reptiles and Batrachians of the West Indies* (1887); *Deep Sea Fishes* (1889); *New Plagiostomia* (1906); *The Reptiles of Easter Island* (1908); *Plagiostomia* (1913).

Garneau, FRANCIS XAVIER (1809–66), Canadian author and official, was born in Quebec. He was educated at a seminary in his native city, and was admitted to practice as a notary in 1830, being made legislative clerk of the assembly that same year. From 1845 he was for twenty years clerk of the city of Quebec. He contributed poems to various periodicals, but his principal work is *Histoire de*

Canada depuis sa découverte (1845, 3d edition 1859).

Garner, JOHN NANCE (1868–), American statesman, was born in Red River County, Texas. He had limited educational advantages, but managed by personal effort to secure some schooling, which included one year at Vanderbilt University. Thereafter he studied law, was admitted to the bar, and began practice in Clarksville, Texas, in 1890. From 1898 to 1902 he was a member of the Texas House of Representatives. He was elected to the House of Representatives in Congress in 1902 and remained there for thirty years (1903–1933). In 1931 he was elected Speaker of the House. He was elected Vice-President in 1932 and re-elected in 1936.

Garnet. The garnets crystallize in the cubic system, usually as rhombic dodecahedra, and have a resinous lustre, a hardness of 7, a specific gravity over 3.3, and a very imperfect cleavage. Their color is mostly brown or red, but may be black, green, or yellow, and colorless crystals are sometimes found. Their chemical composition varies, and they are an excellent example of an 'isomorphous' group. Garnets are found in igneous, sedimentary, and metamorphic rocks. They are commonest in the crystalline schists, in mica schist and gneiss, and in metamorphic limestones, though good specimens are also obtained from veins. The varieties pyrope (dark red), almandine (bluish red) and uvarovite (green) are semi-precious stones, and are used in jewellery, though they are not of great value. Pyrope, which was known to the ancients as 'carbuncle,' is abundant in some serpentines in Saxony and Bohemia. Almandine is mostly obtained from Ceylon, Burma, and Brazil. Uvarovite is found in the Ural Mts. Massive garnet is used extensively also as an abrasive.

Garnet, HENRY HIGHLAND (1815–82), Afro-American clergyman, was born a slave at New Market, Md., of unmixed African descent. Escaping to the North with his parents, he received his education at Canaan, N. H., and Oneida, N. Y., graduating at the Oneida Institute in 1840. After teaching at Troy, N. Y., he studied theology and was pastor of a Presbyterian church in that city from 1842 to 1852. For some time he edited an abolitionist paper, *The Clarion*, and he lectured on slavery in Great Britain from 1850 to 1853. Garnet was a delegate to the peace congress at Frankfort in 1851. He was pastor of the Shiloh Presbyterian Church in New York for most of the time from 1855 to 1881, when he was appointed U. S. minister to Liberia by President Arthur. He took up his residence in that country, but died less than two months after his arrival.

Garnett, city, Kan., co. seat of Anderson co., 70 m. s.s.w. of Kansas City, on the A., T. and S. Fe and two branches of the Mo. Pac. R. R. The chief manufacture is furniture. The surrounding district yields natural gas and is a fertile farming country. Pop. 2,334.

Garnett, HENRY (1555–1606), English Jesuit, born at Heanor, Derbyshire. After being in the employment of Tottel, the law printer, as a corrector of the press for two years, he crossed to Spain, and in September, 1575, joined the Society of Jesus, and was sent back to England in 1586 as provincial of the order. On March 28, 1606, he was tried at the Guildhall for supposed complicity in the Gunpowder plot, and having been found guilty, was sentenced to be hanged and quartered.

Garnett, JAMES MERCER (1840–1916), American philologist, born at Aldie, Va., graduated (1859) at the University of Virginia. He served in the Confederate army, and afterward devoted himself to instruction in the languages and to philological work. He was principal of St. John's College, Annapolis, Md., from 1870 to 1882, and professor of English literature at the University of Virginia from 1882 to 1896, subsequently residing in Baltimore. His *Selections in English Prose* (1891) became a standard educational work. Among his other books are *Translation of Beowulf* (1882), and *History of the University of Virginia* (1904).

Garnett, RICHARD (1835–1906), English writer, was a native of Lichfield. He was appointed assistant librarian in the British Museum in 1851. He became assistant keeper of printed books in 1875, was superintendent of the reading-room from 1875 to 1884, and keeper of printed books from 1890 to 1899, when he retired. He was president of the Library Association (1892–3), and president of the Bibliographical Society since 1895. He was a copious contributor to the *Encyclopædia Britannica* and the *Dictionary of National Biography*. He edited a large number of works since 1859, including the British Museum Catalogue from 1881 to 1890. His edition of Beckford's *Vathek* (in 1893) is remarkable because it solved finally the question of the circumstances of its composition and publication. His principal independent publications are *Primula* (anon. 1858); *Io in Egypt* (1859); *Idylls and Epigrams* (1869); *Life of Thomas Carlyle* (1887); *Life of Emerson* (1888); *The Twilight of the Gods* (1888, new ed. 1903); *Life of Milton* (1890); *Iphigenia in Delphi* (1890); *Poems* (1893); *The Age of Dryden* (1895); *William Blake* (1895); *Sonnets of Dante, Petrarch, and Camoens* (trans. 1896); *History of Italian Literature* (1898); *Life of E. J. Wakefield* (1898); *Essays of an Ex-Librarian* (1901); *The Queen, and Other Poems* (1901); with Mr. E. Gosse, an illustrated *English Literature* (1903–4); and *William Shakespeare* (1905).

Garnett, ROBERT SELDEN (1819–61), American soldier, was born in Essex co., Va., and graduated at West Point Military Academy in 1841. During the Canadian dispute and disturbances in 1842 and 1843, he served as second lieutenant of artillery, and subsequently was an instructor at West Point. During the Mexican War he served as aid to Gen. Taylor, and for gallant conduct at Buena Vista and Monterey he was brevetted major. From 1852 to 1854 he was commandant at West Point, and afterwards served in the expeditions against the Puget Sound Indians. He was travelling in Europe on sick leave, in 1861, but returned to take service in the Confederate army. He was made a brigadier-general, and while attempting to cover a retreat of his troops before the superior forces of McClellan on the Cheat River, W. Va., his army was routed and he himself killed at Carrick's Ford.

Garnier, JEAN LOUIS CHARLES (1825–98), French architect, born at Paris; travelled in Italy and Greece from 1848–54. His design for the Paris opera house was accepted, and he superintended its erection from 1863–74. He also designed the Cercle de la Librairie for the publishing firm of Hachette in Paris, also the casino of Monte Carlo and the observatory of Nice. He published *A Travers les Arts*; *Causeries et Mélanges* (1869); *Etudes sur le Théâtre* (1871); *L'Habitation Humaine*, in collaboration with Ammann (1892).

Garnier, JOSEPH CLÉMENT (1813–81), French political economist, born at Beuil, near Nice. In 1842 he founded, with Guillaumin, the Société d'Economie Politique (of which he remained secretary till his death), and, with Bastiat, Chevalier, and others, the Association pour la Liberté des Echanges. He was professor of political economy successively at the Upper Commercial School in Paris, the Athénée Royal (1843), and the Ecole des

Ponts et Chaussées (1846). Garnier published *Traité d'Economie Politique* (1846; 9th enlarged ed. 1889); *Richard Cobden, les Ligueurs et la Ligue* (1846); *Des Principes de Population* (1857); *Traité des Finances* (1862). He founded (1841) and edited (from 1845) the *Journal des Economistes*. See *Life* by his brother (1882).

Garnier, MARIE JOSEPH FRANÇOIS (1839–73), known as Francis, French naval officer and explorer, born at St. Etienne; sailed to Cochin-China with Admiral Charner; and was commander of the expedition of 1860-2. A member of the expedition through Tibet (1866–8), after penetrating to Tali-fu, the capital of Yün-nan, he successfully reached Shanghai. After serving in the defence of Paris (1870–1) he returned to the East, and met his death after capturing Hanoi, the capital of Tong-king. His chief work, *Voyage d'Exploration en Indo-Chine*, appeared in 1873. See *François Garnier*, by Petit (1895).

Garnier, ROBERT (1534–90), French poet, born at La Ferté-Bernard (Sarthe), held a legal appointment at Le Mans. The merit of his tragedies has won for him the title of forerunner of Corneille. Among them are *Antonius* (1578; new Eng. trans. 1897); *Cornelia* (1574); new Eng. trans. 1894); and *Sédécie ou les Juives* (1583), a Biblical tragedy, one of his best. A collected edition appeared at Paris in 1585, and another in 1883. See *Etude sur Robert Garnier*, by Bernage (1880).

Garnierite, a fibrous or amorphous silicate of nickel and magnesium, found in serpentine rocks in New Caledonia and in Oregon; valuable as a source of nickel. Its color is a fine apple green or emerald green, and it is always massive, granular, or concretionary, never crystallized. As an ore it is easier to treat than the nickeliferous pyrites, which are its chief competitors.

Garnier-Pagès, ETIENNE JOSEPH LOUIS (1801–41), French politician, born at Marseilles, where he practised as an advocate before the outbreak of the revolution of 1830. Hurrying to Paris, he took a prominent part in the proceedings of July, and in 1831 became the acknowledged leader of the democratic party in the Chamber.

Garnier-Pagès, LOUIS ANTOINE (1803–78), French statesman, half-brother of the preceding, also took part in the July revolution, and after his brother's death, in 1841, entered the Chamber and became leader of the extreme Left. Elected mayor of Paris and minister of finance in 1848, he met the financial crisis by successful though unpopular measures. He afterwards served as a member of the Corps Législatif in 1864, and of the provisional government of 1870–71. His chief work was the *Histoire de la Révolution de* 1848 (1861–72), besides which he published *Histoire de la Commission Exécutive* (1869–72) and *L'Opposition et l'Empire* (1873).

Garnishment. A legal process under which the personal property of a defendant in an action, in the possession of another, or his claims against others, are attached or seized by the officer executing the writ, and held, if chattels, or payment stopped, if credits or claims, pending the determination of the action, for the benefit of the plaintiff. The object is to prevent the property from being turned over to the defendant or the money being paid to him until his liability can be determined. It is sometimes known as 'trustee process,' as the garnishee's position is virtually that of a stakeholder, subject to the order of the court, after the process is served upon him. See ATTACHMENT.

Garofalo, brush-name of BENVENUTO TISI or TISIO (1481–1559), Italian painter, born at Ferrara; worked for some years at Ferrara; and finally, coming into contact with Raphael at Rome in 1509, accepted him as his master and model. Returning to Ferrara, he worked there until overtaken by blindness in 1550. His pictures show vigor of coloring, but a conventionality in drawing which asserts itself increasingly in his later work.

Garonne, riv. of France, rises E. of Maladetta, the highest peak in the Pyrenees, and flows generally N. to Toulouse through the dep. Haute-Garonne. From Toulouse to the mouth of the Gironde estuary its direction is generally N.N.W., the whole course being 350 m. It receives on the r. bk. the Ariège, the Tarn, the Lot, and the Dordogne.

Garonne, HAUTE-. See HAUTE-GARONNE.

Gar-pike. (1.) A species of the fish genus Belone, which are common in temperate and tropical seas. The jaws are prolonged

Gar-pike.

into a slender beak, by means of which the fish snap up the small prey on which they feed. All the rays of the dorsal and anal fins are united by membrane. In the seas of N. Europe generally occurs *B. vulgaris*, which grows to a length of about two feet. It is edible, but the bones are green. The gar-pike belongs to the family Scombresocidæ, to which the flying-fish also belongs. (2.) The name is also given to the bony pike or billfish, a ganoid fresh-water fish of the genus Lepidosteus, found in America, where the most common and widespread species is *L. osseus*. The body has an armor of enamelled scales, is elongated, and terminates in a remarkable beak-like snout furnished with strong teeth. In the lower Mississippi occurs a larger and more local species known as alligator gar (*L. tristœchus*) or manjuari—a huge, muscular, voracious fish useless for food. See BONY PIKE.

Garrard, KENNER (1828–79), American soldier, was born in Cincinnati, and graduated at West Point in 1851. During the next ten years he served on topographical surveys. At the outbreak of the Civil War he was captured by Texan troops, but was soon released on parole. He served as instructor and afterward as commandant at West Point from Sept., 1861, to Sept., 1862, when he was exchanged. As colonel of the 146th N. Y. regiment, he took part in the battles of Fredericksburg, Chancellorsville, and Gettysburg. In 1863 he was promoted to be brigadier-general of volunteers, and in 1864, as commander of a cavalry division in the Army of the Cumberland he was engaged chiefly in independent expeditions around Chattanooga and in Georgia. For his success in the one against Covington, Ga., he was brevetted colonel in the U. S. army. In Dec., 1864, he was brevetted major-general of volunteers and placed in command of the second division of the sixteenth army corps. For his conduct at the battle of Nashville, in the operations against Mobile, and as head of the storming column capturing Blakely, he was brevetted brigadier-general in the regular army. For other services during the war he was brevetted major-general. At the close of the war he was placed in command of the Mobile district, and in 1866 served as in spector-general of the Department of Missouri. In Nov., 1866, he resigned from the regular army, and from 1871 until his death held expert municipal positions in Cincinnati.

Garrett, city, De Kalb co., Ind., 20 m. N. of Fort Wayne, on the B. and O., and the Toledo and Chicago Interurban R. Rs. Shops of the B. and O. R. R. are situated here, and gas and gasoline engines are manufactured. It is surrounded by a fertile farming district. It contains the Sacred Heart Hospital. It was settled in

1875 by the Baltimore Land Improvement Co., and incorporated as a town in the same year. Pop. (1900) 3,910; (1930) 4,428.

Garrett, JOHN WORK (1820–84), American railroad official, was born in Baltimore, Md. He entered into business with his father and brother, as Robert Garrett & Sons. In 1857 he became associated with the Baltimore and Ohio Railroad as a director, and served as its president from 1858 until his death. During his administration the system was greatly extended and improved. He was long a trustee of Johns Hopkins University.

Garrett, JOHN WORK (1872), American diplomat, was born in Baltimore, Md. He was graduated from Princeton in 1895. In the following year he entered the banking firm of Robert Garrett & Sons. He served as secretary to the American legation at The Hague (1901–03), during which period he also acted as secretary to the Arbitral Tribunal; at the Netherlands and Luxemburg (1903–05); and to the American embassy at Berlin (1905–08) and at Rome (1908–10). He has been U. S. minister to Venezuela (1910–11), and to the Argentine Republic (since 1911).

Garrett, THOMAS (1789–1871), American merchant and reformer, was born in Upper Darby, Pa. In 1820 he removed to Wilmington, where he became a prosperous iron merchant. He was widely known as a friend of the negro, and during his life aided about 3,000 fugitive slaves to gain their freedom. He was so successful in this work that slave owners usually abandoned pursuit when they found that the fugitives had sought refuge with him. In 1848 he was prosecuted before Judge Taney, and was fined so heavily as to ruin him financially; whereupon his Wilmington fellow citizens advanced him sufficient capital to renew his business and regain a competence.

Garrick, DAVID (1717–79), English actor, manager, and dramatist, was born in Hereford, the grandson of a Huguenot refugee. He was a pupil of Samuel Johnson (q. v.), with whom he journeyed to London in 1737. He was at first a wine merchant; but his early predilection for the stage was strengthened by continued study of the drama, and by acquaintance with Charles Macklin (q. v.) and other actors. After several trials in the provinces, he appeared at Goodman's Fields (London), on Oct. 19, 1741, as Richard III., achieving an immediate and extraordinary success. His first London comedy part was Clodio in Cibber's *The Fop's Fortune* (1741). From 1742 to 1746 he appeared at the Drury Lane Theatre; and after 1747—when he became, with Lacy, joint proprietor—he played there for twenty-nine years more. In 1776 he sold half his share in the theatre to R. B. Sheridan (q. v.) and others for £35,000, and retired from the stage. He was buried in Westminster Abbey.

Garrick elevated the whole tone of the stage; substituted for the old stilted and declamatory style one more vivacious and natural; and greatly increased the popularity of Shakespearean performances. His repertory included his own adaptations of French and English dramatists (Shakespeare, Ben Jonson, etc.), and plays by Buckingham, Cibber, and others. Lear has been accounted his greatest part; but by some he has been judged to excel in comedy. His versatility was extraordinary, the *rôle* of romantic hero being perhaps the only one in which he failed to achieve supreme success. *Lethe* is the only play known to have been wholly of his composition. He wrote numerous prologues and epilogues of merit.

Consult his *Private Correspondence*, with Memoir; *Life* by Davies, by Murphy, by Percy Fitzgerald, and by Knight; Mrs. Parsons' *Garrick and His Circle* (1906); Martin's *Monographs: Garrick, Macready, Rachel, and Baron Stockmar* (1906); *Unpublished Correspondence*, edited by G. P. Baker (1907); Hedgcock's *David Garrick and His French Friends* (1912).

Garrison, a collective term denoting the officers and men stationed at a military post or camp for the purpose of manning its defences, taking care of the property, as well as for drill and instruction. A Garrisoned Post is one occupied by troops, of which there are 137 in the United States and its insular possessions (June, 1912). In the U. S. army, of late years, there has been a tendency to concentration of troops (except in the Coast Artillery), and a consequent reduction in the number of posts.

Garrison, LINDLEY M. (1864–1932), American Cabinet officer, was born in Camden, N. J. He was educated at Exeter, Harvard, and the University of Pennsylvania, and was admitted to the Philadelphia bar in 1886. In 1892 he removed to Jersey City, and became senior member of the law firm of Garrison, McManus & Enright. He served as vice-chancellor of New Jersey in 1904–11, and in the latter year was reappointed by Chancellor Pitney for the term 1911–18. In 1913 he became Secretary of War in President Wilson's Cabinet.

Garrison, WENDELL PHILLIPS (1840–1907), American journalist, son of William Lloyd Garrison (q. v.), was born in Cambridgeport, Mass., and was graduated (1861) from Harvard. From 1865 to 1906 he was literary editor of *The Nation*, in which position he exerted an immense influence on American literature. With his brother, Francis J. Garrison, he was joint author of *William Lloyd Garrison—The Story of His Life* (1885). He also published several memorial volumes, books for children, and *Sonnets and Lyrics of the Ever-Womanly* (1898). Consult *Letters and Memorials of Wendell Phillips Garrison* (1908).

Garrison, WILLIAM LLOYD (1805–79), American reformer, and leader of the Abolitionists in the anti-slavery struggle, was born in Newburyport, Mass., on Dec. 10, 1805. His father, Abijah Garrison, a sea captain, deserted his family when William was only three years old. After a brief period of schooling, William was apprenticed, when nine years old, to a shoemaker of Newburyport. In 1815 his mother removed to Baltimore, and in 1818 he was apprenticed to the Newburyport *Herald*, where he became an expert printer and foreman.

At the end of his apprenticeship (1826), Garrison became editor and proprietor of the short-lived Newburyport *Free Press*, in which Whittier's first poems appeared. The venture proving unsuccessful, he went to Boston, where for a year he edited *The National Philanthropist*, whose avowed object was 'the suppression of intemperance and its kindred vices.' In 1828–9 he edited at Bennington, Vt., *The Journal of the Times*.

In 1829 Garrison joined Benjamin Lundy (q. v.) in the editorship of *The Genius of Universal Emancipation*, published at Baltimore. Baltimore was then an important slave market, and Garrison aroused the dealers by his fiery denunciations of the domestic slave trade. In 1830 one of these dealers sued him for libel, and secured a verdict for $50 and costs. After spending seven weeks in jail, he was released when Arthur Tappan of New York paid his fine.

Garrison severed his connection with *The Genius*, and proceeded to Boston, where on Jan. 1, 1831, appeared the first number of a paper of his own, the famous *Liberator*. Garrison's

salutatory was characteristic: 'I will be as harsh as truth, and as uncompromising as justice. On this subject I do not wish to think, or speak, or write with moderation. I am in earnest—

William Lloyd Garrison.

I will not equivocate—I will not excuse—I will not retreat a single inch—and I will be heard!'

In the period before the Civil War other anti-slavery journals were conducted in the North, but none was as conspicuous as *The Liberator;* and Garrison was the embodiment of the Abolitionist cause. *The Liberator* soon attracted attention throughout the North, and caused consternation in the South, where the mere possession of a copy came to be regarded as a serious offence against the community. In December, 1831, he was indicted for sedition in North Carolina, while the legislature of Georgia offered a reward of $5,000 for his conviction in accordance with the laws of that State. On Oct. 21, 1835, a mob broke up one of his meetings in Boston, and he was so roughly handled that he had to be rescued by the police and lodged in jail for his own safety.

Garrison did not confine his anti-slavery propaganda to *The Liberator.* He took the initiative in founding the New England Anti-Slavery Society (1832); issued an able and effective pamphlet, *Thoughts on African Colonization* (1833), against the National Colonization Society; was sent (1833) by the New England Anti-Slavery Society to England, to convince Abolitionist leaders there of the futility of colonization; and was conspicuous among the founders of the American Anti-Slavery Society (1833), whose declaration of principles he prepared, and of which he was president from 1843 to 1865. He also delivered throughout the North numerous anti-slavery lectures and addresses.

With all the intensity of his nature, Garrison believed slavery to be a heinous crime against humanity, and that slave owners were steeped in moral guilt. Therefore he denounced the slave holders in unmeasured terms, and did much to embitter the South against the North. Despite opposition, threats, and personal mistreatment he courageously persevered, and with his associates eventually succeeded in arousing the conscience of the North to the evils of slavery.

Garrison was the leader of the distinctively moral struggle against slavery. Upon the adoption of the Thirteenth Amendment he felt that his work was done, and he therefore discontinued *The Liberator* and withdrew from the presidency of the American Anti-Slavery Society.

The long struggle had left him without means, and in 1868 the sum of $31,000 was raised for him by subscription as a 'national testimonial.' During his last years he supported various reforms, especially prohibition. He died in New York on May 24, 1879. He published a volume of *Sonnets and Other Poems* (1843).

Consult W. P. and F. J. Garrison's *William Lloyd Garrison—The Story of His Life Told by His Children;* Oliver Johnson's *W. L. Garrison and His Times;* Goldwin Smith's *The Moral Crusader;* Grimke's *William Lloyd Garrison the Abolitionist;* Swift's *William Lloyd Garrison* (1911).

Garrison, WILLIAM LLOYD (1838–1909), American reformer, was born in Boston, and was educated in public schools there. He was a bank cashier at Dorchester, Mass. (1862–4); a wool merchant in Boston (1866–83); and a dealer in securities (1883–1901). He was then secretary of the American Free Trade League. He had an abiding interest in many reform movements, which found expression in numerous addresses in behalf of free trade, woman's suffrage, the single tax, etc.

Garrote, a method of execution which originated in Spain, and which was also formerly employed in the Spanish colonies. The word means literally stick, and the name was formerly appropriate, as this form of execution originally consisted in seating the victim in a chair with his neck against a post, then placing a rope around his neck and the post, and twisting it about the neck by means of a stick inserted in the rope back of the neck until strangulation was produced. This was superseded by a device consisting of a brass collar, with a screw inserted at the point where it would touch the back of the neck, and operated by turning the screw until its point pierced the spinal cord, thus producing death.

Garrucha, seaport, Spain, on the Mediterranean; 40 miles northeast of Almeria. It exports iron ore (447,746 tons in 1911), lead ore, esparto, and fruits. Pop. 4,700.

Garrus, or GERUS, province, Persia, between Azerbaijan and Hamadan. Its capital is Bijar. Pop. 80,000.

Garrya, a genus of evergreen shrubs belonging to the order Cornaceæ. The long, drooping catkins in spring are often a foot in length. The best known species is *G. elliptica,* a native of California, which is very handsome.

Garston, town and port on the River Mersey; 6 miles south of Liverpool, England. There are railway docks, bobbin, iron, and copper works. Pop. 18,000.

Garter, THE MOST NOBLE ORDER OF THE, a famous British order of knighthood, instituted by King Edward III., probably in 1344. The color of the emblem chosen was blue, the French livery color, and the motto, *Honi soit qui mal y pense.* The oftencited tradition as to emblem and motto is that the Countess of Salisbury dropped her garter when dancing with the King, and the King, picking it up, tied it round his leg; but observing the Queen's jealous glances, he returned it to its fair owner with the remark, '*Honi soit qui mal y pense*' ('Dishonored be he who thinks ill of it').

The habits and ensigns of the order originally consisted of the garter, surcoat, mantle, and hood, to which were afterward added the collar and George, the star, and the under habit. The *Garter,* which was at first of light blue silk, with the motto sometimes set in pearls, rubies, and diamonds, and is now of dark blue velvet about one inch wide, with the motto in gold letters, is worn on the left leg a little below the knee. When the sovereign is a queen, she wears it, as a sovereign of the order, on the left arm above the elbow.

The officers of the order are the Prelate, who has always been the bishop of Winchester; the Chancellor, formerly the bishop of Salisbury, now the bishop of Oxford; the Registrar, who is the dean of Windsor; Garter

King-of-Arms; and the Gentleman Usher of the Black Rod.

Knights of the Garter write K.G. after their names. For two centuries past the companions have been almost exclusively peers or the eldest sons of peers. See ORDERS OF KNIGHTHOOD. Consult Ashmole's *Institution, Laws, and Ceremonies of the Order of the Garter.*

Garter King-of-Arms, the chief of the official heralds of England, and Officer of Arms of the Order of the Garter (q. v.). See also HERALD.

Garter Snakes, (*Eutænia* or *Thamnophis*), a genus of non-poisonous snakes common throughout the United States, and found also in Southern Canada, Mexico, and as far south as Guatemala. They vary in size and color. A large specimen is about three feet long and one inch thick in its greatest diameter, and the usual pattern is three light stripes on a darker ground—one along the middle of the back and one on each side. The ventral surface is slate colored. They have from 17 to 23 longitudinal rows of overlapping dorsal scales, 132 to 180 abdominal plates, a single anal plate, and 49 to 134 subcaudal plates.

Garter snakes inhabit swamps, woods, rocky fields and grassy meadows, and feed upon earth worms, tadpoles, fish, frogs, toads, small mammals, and birds. Some species are semi-aquatic. In the northern parts of their range they hibernate from December to March, and are gregarious in the winter and spring, during the breeding season. The eggs are hatched within the body of the mother, and the young (5½ to 7½ inches long), which may number from 30 to 50, are independent from birth. They are produced usually in late summer, mature in a year, and breed the following spring.

Among the most common species are *E. sirtalis*, the Common Garter Snake, found in all parts of North America; *E. elegans*, confined to the Pacific Coast region and distinguished by its handsome coloring; *E. radix*, in the plains region, especially fond of fish; *E. saurita*, known as the Eastern Ribbon Snake, similar to a water snake in its habits; and *E. proxima*, the Western Ribbon Snake, larger and stouter than the eastern species, but also aquatic in habit.

The genus was called *Eutænia* by Baird and Girard in 1853, but *Thamnophis*, suggested by Fitzinger in 1843, was incorporated in the code adopted at the International Zoological Congress in 1907. As many as sixty forms of this genus have been noted and thirty are said to be recognized by herpetologists. Consult *Bulletin No. 61* of the U. S. National Museum (1908), and Ditmar's *Reptiles of the World.*

Garth, gärth, SIR SAMUEL (1661–1719), English physician and poet, was born in Bowland Forest, Yorkshire, and became a popular physician in London. He delivered the Harveian oration for 1697. In 1699, with Dryden's *MacFlecknoe* and Boileau's *Lutrin* for models, he published his mock-heroic poem, *The Dispensary*, the satire of which is pungent, and the heroic couplets the best produced between Dryden and Pope. In 1717 he superintended and contributed to a translation of Ovid's *Metamorphoses* by Addison, Pope, Gay, Congreve, Rowe, and others.

Gartok, gär-tok′, town, Western Tibet, capital of Nari-Khorsum province. It is over 14,000 feet above sea level, in an outlying valley of the Himalayas. The richest gold field of Tibet, Thok-Jalung, lies about 85 miles northeast.

Garua, gä-rōō′ä, a thick ocean mist, usually prevalent in the winter months, in the rainless regions along the Peruvian coast.

Garuda, in Indian mythology, the creature on which Vishnu rides. It is half man and half bird, and has the head, wings, beak, and talons of an eagle. The body and limbs are human, the face is white, the wings red, and the body golden. Garuda is the lord of all birds and the implacable foe of snakes, which are his half-brothers.

Garvice, CHARLES (d. 1920), English novelist, wrote prolifically for many years. He was a correspondent for several newspapers in England and the United States, but is known chiefly for his popular novels and plays, which he produced to the number of more than a hundred. His novels include *Nance* (1900); *Just a Girl* (1902); *Love Decides* (1904); *Love the Tyrant* (1905); *Diana and Destiny* (1906); *The Gold in the Gutter* (1907); *Kyra's Fate* (1908); *The Scribblers' Club* (1909); *Barriers Between* (1910); *The Heart of a Maid* (1910); *The Lady of Darracout* (1911); *Adrien Leroy* (1912); *Two Maids and a Man* (1912).

Garwhal, India. See TEHRI.

Gary, gā′ri, city, Indiana, in Lake county, on the Baltimore and Ohio, the Elgin, Joliet and Eastern, the Indiana Harbor Belt, the Michigan Central, the New York Central, the Pennsylvania, and the Wabash Railroads; on the southern shore of Lake Michigan. The greater part of the site was bought by the U. S. Steel Corporation in 1906, which proceeded to establish here large steel works and other industries, and a model town for its employees. The town is well adapted for a great industrial centre, as it is served by eight railroads and several steamboat lines on the lakes. It was incorporated in 1906, and extended in 1910. It is named for Elbert H. Gary (q. v.). The Gary Plan of education developed here attracted widespread attention. Pop. (1920) 55,378; (1930) 100,426; (1940) 110,863.

Gary, ELBERT HENRY (1846–1927), American lawyer and financier, born in Wheaton, Ill. He was educated at Wheaton College and the University of Chicago, was admitted to the Illinois bar in 1867, and to the bar of the U. S. Supreme Court in 1882. He served as president and mayor of Wheaton and as county judge of Du Page county, practised law in Chicago for twenty-five years, and was president of the Bar Association of that city (1893). In 1898 he was made president of the newly organized Federal Steel Company, and later took an active part in the formation of the U. S. Steel Corporation, of which he became chairman of the board of directors and of the finance committee. He also held numerous directorships in other corporations, and was president of the American Iron and Steel Institute.

Gary, FRANK BOYD (1860–), American legislator, was born in Abbeville, S. C. He was graduated from Union College; studied law, and was admitted to the bar in 1881; and since then has practised in Abbeville. He was a member of the South Carolina legislature (1890–1900 and 1906), and held office as speaker (1895–1900); was a member of the Constitutional Convention (1895); and was elected to the U. S. Senate for the unexpired term 1908–09.

Gary Plan. See EDUCATION IN THE UNITED STATES.

Gas. See GASES; GAS LIGHTING; GAS MANUFACTURE.

Gas, Acetylene. See ACETYLENE.

Gas Burners. It is of prime importance that gas fittings should be adequate to supply the required volume of gas; that the gas should emerge from the burners under low pressure; and that there should be a governor for each burner or small group of burners. Thereby a full and steady flame is obtained with a comparatively slow supply of gas; the incandescent particles or vapors upon which luminosity depends are allowed to remain as long as possible in the flame; and the gas is thoroughly burned.

Until recent years the gas burners chiefly in use were the *Batswing Burner*, with a slit across a hemispherical head; the

Fishtail Burner, with two holes converging toward one another; and the *Argand Burner* (q. v.), with a circle of holes. All such burners, however, are economically inferior to the *Incandescent Burner*, first invented by Auer Von Welsbach, and have been largely supplanted by the latter. The Welsbach is a Bunsen burner (q. v.) over the flame of which is fitted a mantle consisting of thoria and a little ceria, emitting a brilliant white light on incandescence. (See GAS MANTLES.)

The *Multiple Flat-Flame Burner* is a group of three or five batswing or fishtail burners arranged in a circle, so that the broad sides of the flames face outwardly around the circumference. The *Regenerative Burner*, as recently improved, has an annular flame surrounding a central porcelain cylinder. The products of combustion are drawn down through the cylinder, and into a chamber through which passes the air that feeds the flame. This burner, which is effective and economical, is used in stores and public halls, and for street lighting. The *Albo-Carbon Burner* affords a soft, steady, and very white light by the addition to the gas, as it enters the flame, of hot vaporized carbon from a receptacle in the burner.

Gas City, city, Indiana, Grant county, on the Missinnewa River, and on the Pennsylvania Railroad; 6 miles southeast of Marion. It has glass factories. It was originally called Harrisville, and was incorporated as Gas City in 1891. Pop. (1910) 3,224; (1920) 2,870.

Gascoigne, gas-koin', GEORGE (*c.* 1535–1577), English poet and dramatist, was born in Cardington, Bedfordshire. He is supposed to have joined Middle Temple and tradition presents his escapades at this period as notorious. About 1572 his poems were published and he wrote some plays which were produced, translating Ariosto's *Gli Suppositi* and assisting in *Jocsta*, an adaptation of the *Phœnissæ* of Euripedes. After serving with the army in the Netherlands, he returned to England and had a share in devising the masques which celebrated Queen Elizabeth's visit to Leicester. His works include: *A Hundred Sundry Flowers* (1572), enlarged as *Posies* (1575); *A Glasse of Government* (1575); *The Steele Glas* (1576); *The Complaynte of Phylomene* (1576); *Princely Pleasures at the Court of Kenilworth* (1576). Consult Schiller's *Life*.

Gascoigne, SIR WILLIAM (1350–1419), English judge, was appointed on the accession of Henry IV. a justice in the court of common pleas, and in November, 1400, was raised to be chief justice of the King's Bench. He was undoubtedly a great lawyer and evidently a fearless judge, as he refused to obey the king's command to sentence to death Archbishop Scrope and Mowbray after the northern insurrection in 1405.

Gasconade River, gas-ko-nāde', rises in Wright county, Missouri, in the Ozarks, and winds for more than 200 miles northeastward through a hilly and picturesque country, till it empties into the Missouri, 35 miles below Jefferson City.

Gascons. See GASCONY.

Gascony, gas'kun-i (Latin *Vasconia*), an ancient district in Southwestern France, situated between the Bay of Biscay, the River Garonne, and the Western Pyrenees, and now included in the departments of Landes, Gers, Hautes-Pyrénées, and the southern portions of Haute-Garonne, Tarn-et-Garronne, and Lot-et-Garonne. The total area is over 10,000 square miles.

Gascony derived its name from the Basques or Vasques, who, driven by the Visigoths from their own territories on the southern slope of the Western Pyrenees, crossed to the northern side of that mountain range in the middle of the sixth century, and settled in the former Roman district of *Novempopulana*. In 602, after an obstinate resistance, the Basques were forced to submit to the Franks. They then passed under the sovereignty of the dukes of Aquitania, who for a time were independent of the crown, but who were afterward conquered by King Pepin, and later by Charlemagne. Subsequently Gascony became incorporated with Aquitaine, and shared its fortunes.

The inhabitants, numbering about a million, have preserved not only their dialect and customs, but even their distinct individuality alike in outward aspect and in their good temper. The Gascon is little in stature and thin, but strong and lithe in frame, with fine eyes and high color. He is ambitious and enterprising, but passionate and given to boasting and exaggeration. Hence the name *Gasconade* has gone into literature as a synonym for harmless vaporing. The Gascons, moreover, are quick-witted, cheerful, and persevering, and make capital soldiers.

Gas Engines are engines in which the motive power is obtained by the combustion of an explosive mixture of gas and air inside the motor cylinder. Hence they belong to the class of 'internal combustion' engines, in contradistinction to steam engines, in which the working agent—steam—is produced separately. They are similar in principle to *Oil Engines* (See OIL AND GASOLINE ENGINES), except that in the latter a mixture of oil vapor and air is used for combustion.

The thermal efficiency—*i.e.*, the ratio of heat transformed into mechanical work as compared with the total heat supplied—is much greater in a gas engine than in a steam engine and boiler. A small-power gas engine using ordinary city gas is also much more economical than a similar-sized steam engine and boiler; but with large units using city gas the reverse is the case. However, gas engines, except those of small power, are now worked with a cheap form of producer gas, and are more economical than the best designed steam engines and boilers. (See FUELS.)

LENOIR ENGINE.—The first practical working gas engine was brought out by Lenoir in 1860. In construction it was similar to the ordinary horizontal double-acting steam engine. Two slide valves worked by eccentrics were provided. One slide valve controlled the admission of gas and air; while the other, on the opposite side of the cylinder, allowed the products of combustion to escape to the atmosphere at the proper moment. To prevent the cylinder from becoming excessively hot, it was fitted with a water jacket. The working of the Lenoir engine was as follows: Alternately at each end of the cylinder, air and gas, in suitable proportions, were drawn in; at about half stroke the inlet valve was closed, and the mixture immediately exploded, at about atmospheric pressure, by an electric spark. The explosion produced a rapid rise of pressure, and forced the piston to the end of the stroke, at the same time expelling from the cylinder the products of combustion of a previous explosion on the opposite side of the piston. On account of the excessive consumption of gas (about 100 cubic feet per horse power per hour) this engine was soon discarded.

OTTO AND LANGEN.—In 1866 Otto and Langen introduced their atmospheric and free piston

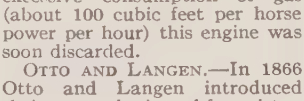


FIG. 1.—*Lenoir Cycle Diagram.*

gas engine, which consisted of a very tall vertical cylinder, open at the top and provided with a piston, whose rod was formed like a rack, and geared with a spur wheel on the main shaft, driving it by means of a very ingenious clutch gear only during

Gas Engines

the down stroke of the piston. On the ignition of the charge by a gas flame the piston rose freely, the expansion being very rapid, and the pressure fell below that of the atmosphere. On the down stroke the clutch came into action, and the shaft received mechanical energy. The Otto and Langen worked much more economically than any previous engine, the consumption of gas being about 44 cubic feet per brake horse power per hour.

Otto Cycle Type.—Otto himself, in 1876, brought out an entirely new design. The important innovation in the Otto engine was the compression in the motor cylinder of the charge of gas and air prior to ignition, and from this period the gas engine became a serious competitor of the steam engine. Dr. Otto was not the original inventor of the compression principle, however. Beau de Rochas, in 1862, laid down the precise principles upon which the best modern gas engines are working; but Otto converted the theory into practical success.

The four-stroke cycle of Beau de Rochas and Otto, commonly known as the Otto cycle, may be best followed in Fig. 2, which represents a longitudinal section of an Otto cycle gas engine in diagrammatic form. In modern engines the inlet valve is usually at the top of the combustion chamber opposite the exhaust valve, but inverted. During the first forward or *charging* stroke of the cycle, gas and air are drawn into the cylinder by the suction of the piston. On the return or *compression* stroke the mixture is compressed into the clearance space, which is usually about 30 per cent. of the working volume of the cylinder. The charge is then ignited as the crank reaches a dead point, an explosion takes place, and the third or *working* stroke is performed under the pressure of the heated products of combustion. During the next return or *exhaust* stroke the above products are expelled from the cylinder into the atmosphere. Thus to complete the action requires four strokes of the piston, or two revolutions of the crank shaft (Fig. 2).

Most modern gas engines are single acting, and work on the Otto cycle, although within recent years there has been a tendency to revert to gas engines which have a greater frequency of impulse than one per two revolutions when running under full load. The original Otto engine was of the horizontal type, the cylinder being open at the crank end, and provided at the back end with a slide valve, which was made to move transversely by means of a side lay shaft running at half the speed of the crank shaft. This slide valve controlled the admission of gas and air; and the ignition of the charge was effected by carrying a flame, through a narrow port in the slide valve, from a gas jet which was kept burning outside. The products of combustion were discharged through a separate valve of the mushroom type, operated from a cam on the side shaft.

On account of the high temperature and greater pressures which are now common, the slide valve has been replaced by lift valves of the mushroom type, as shown in Fig. 2; while low compression and flame ignition gave place to high compression and tube ignition. Except for small stationary engines, where a rich gas is available, tube ignition has been supplanted, in turn, by electrical means of firing—usually an electric spark.

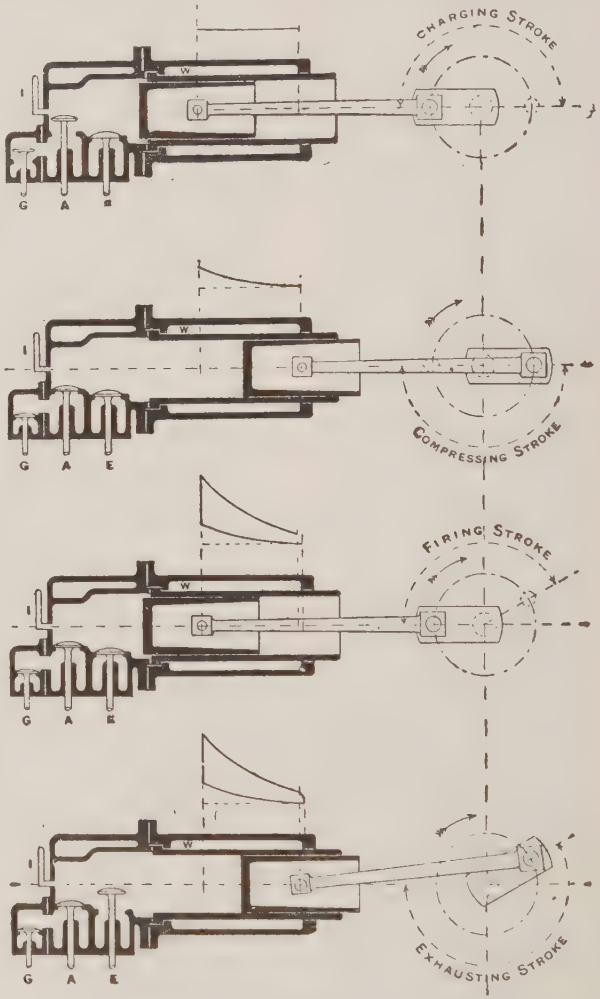


Fig. 2.

Pistons of single-acting gas engines are invariably of the trunk type, and the cylinders are kept cool enough to admit of lubrication by means of jackets through which a continuous circulation of water is maintained. In large gas engines the pistons and exhaust valves are also water cooled. This is done in order to prevent pre-ignition in conse-

Gas Engines

quence of the excessive heating of the piston, etc.; also, with a water-cooled piston a much tighter fit can be obtained in the cylinder, as the amount of expansion is very small owing to

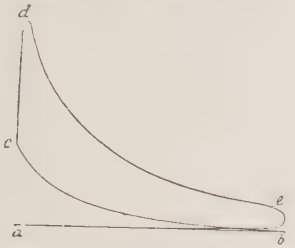


FIG. 3.—*Otto Cycle Diagram.*

a to *b*, charging stroke; *b* to *c*, compression stroke. Ignition takes place at *c*, the pressure rising to *d*; *d* to *e*, expansion or working stroke; *e* to *a*, exhaust stroke.

the temperature of the piston being kept fairly constant.

The speed of a gas engine is usually regulated by a centrifugal governor, which acts on the gas valve so as to cut off the supply when the speed exceeds a certain limit, causing the engine to miss one or more explosions.

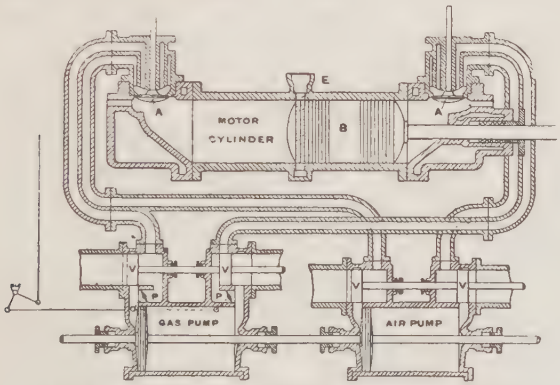


FIG. 4.—*Körting Gas Engine: Diagrammatic Section.*

This is termed the 'hit-and-miss' principle. The charge of gas and air admitted into the cylinder is the same in amount whatever the load, and the impulses are consequently of approximately uniform intensity, but are varied in frequency to suit changes in the load. In some engines, where extreme regularity of working is necessary, a modification is made, whereby the *strength* of the explosive mixture is controlled, and an impulse takes place at *every* cycle. This method of governing is known as the 'quality' system. In other engines the *quantity* of the mixture is regulated. A combination of the quality and quantity systems is also used with good results.

When working on the Otto cycle there is a considerable volume of products of combustion retained in the clearance space of the cylinder at the end of each exhaust stroke; but most modern engines are so arranged that the cylinder is effectually cleared of the exhaust gases. The sweeping out of the exhaust gases or 'scavenging,' as it is generally termed, is effected in various ways. In some engines air is forced into the cylinder by a separate air pump or other equivalent. The air and exhaust valves are open together for a portion of the cycle, allowing an inrush of air toward the vacuum, which flushes the combustion chamber. In the Crossley engine the result is obtained by using a long exhaust pipe in which the exhaust gases are sprayed with cool water, and a partial vacuum formed.

Probably the greatest advance that has been made since 1889 in connection with the development of the gas engine is in the use of producer and blast-furnace gas for motive-power purposes. (See FUELS.) The heating value of producer gas is only about one-fourth that of the average coal gas used for illuminating purposes; but it can be made very cheaply, and it enables the gas engine to provide power at a cost much less than in the case of a steam engine. The Mond process is specially adapted for the use of a cheap fuel (bituminous slack) and the recovery of ammonia. Many engines of very large power are now in successful operation with blast-furnace waste gas, both in the United States and in Europe.

With gas engines of above 25 H. P. it is necessary to provide some suitable mechanical or other means for setting the engine into motion. In some an explosive charge of gas and air is introduced into the cylinder, the pressure produced by the explosion of the charge being sufficient to start the piston. Another method is, by a suitable arrangement of valves, to convert the engine for a short time before stopping into an air compressor, and using the compressed air in starting. Other gas engines are provided with a separate air pump for this purpose, or a small auxiliary dynamo is thrown into gear with the flywheel.

KÖRTING.—The Körting gas engine has a long cylinder and is double acting. Fig. 4 shows a diagrammatic horizontal section through the motor cylinder and the two pump cylinders, one of which supplies air and the other gas. The pumps are driven by an auxiliary crank set at 110 degrees ahead of the main crank, and are provided with piston valves V, driven by an ordinary eccentric on the crank shaft. Separate pipes convey the gas and air into openings in front of the admission valves A. The length of the piston B is practically half that of the motor cylinder. There is no separate exhaust valve, but the motor piston acts in that capacity. The exhaust ports E are situated at the centre of the cylinder, and are uncovered when the piston is at either end of its stroke. When in that position, a scavenging charge of air from the air pumps sweeps out the products of combustion. In Fig. 4 the piston has not reached the end of its stroke; consequently the exhaust ports are not yet uncovered. After the burnt products have been displaced, a mixture of gas and air is pumped into the cylinder. On the return stroke, as soon as the exhaust ports are covered, compression begins; and finally, when the crank is on its dead centre, ignition takes place, and the working stroke is made. Both sides of the piston are utilized, and thus two impulses are obtained for each revolution of the crank. The turning moment on the crank shaft approaches in evenness to that obtained with a double-acting steam engine. The speed is regulated through a governor, which acts on a by-pass valve in the gas suction in such a manner that more or less gas is returned to the main gas pipe, and only a portion of the pump volume is delivered into the motor cylinder, according to the work to be done. The ignition is brought about electrically. The cylinder, piston, and valves

Gas Engines

are all cooled by water. These engines are made in sizes up to 1,000 horse power in one cylinder, are made with one, two, or four cylinders and are worked with producer or blast-furnace gas.

WESTINGHOUSE.—In the Westinghouse engine of the vertical type, there are two or three cylinders, and the Beau de Rochas (four stroke) cycle is used in each cylinder, but in alternation. The two-cylinder engine receives one impulse per revolution, and the three-cylinder engine one impulse for every two-thirds of a revolution. The gas and air, in proper proportions, enter a mixing chamber by separate inlets, and the mixture passes through a port to a space in the cylinder head in which the inlet valve is situated. On the down stroke of the piston the inlet valve is open, and the charge of gas and air is drawn into the cylinder. The charge is compressed into the clearance space on the return upward stroke; and when the crank is just passing the upper dead center, the charge is ignited by an electric spark, which passes between the terminals fixed in an igniter plug. There are two pairs of sparking points, one pair being reserved for emergency. The working stroke is then made, and on the next return stroke the exhaust valve is opened by a cam-and-lever action, discharging the burnt gases into the exhaust pipe.

The governor is of the centrifugal type and acts upon a regulator valve, which controls the admission of both gas and air to the mixing chamber. As the load of the engine changes, the regulating valve moves up or down, increasing or decreasing the quantity of the mixture without altering its quality. Should it be necessary, however, to alter the strength of the charge, means are provided by which the area of the gas and air openings in the regulator can be varied while the engine is running.

Above 350 B.H.P., the Westinghouse is built only of the horizontal type. In the United States, Westinghouse engines of 600 to 1,500 B.H.P. are operated very successfully with natural gas, which has a heating value of about 1,000 B.T.U. per cubic foot. When using about 10 cubic feet per brake-horse-power per hour, the heat efficiency appears to be 25 per cent and the mechanical efficiency from 79 to 87 per cent. The Westinghouse engine is also made in the tandem type—two pistons on one piston rod working in two separate cylinders placed one behind the other, on the four-stroke cycle. With three or four pairs of cylinders the drive is remarkably steady, and vibration is reduced to a minimum.

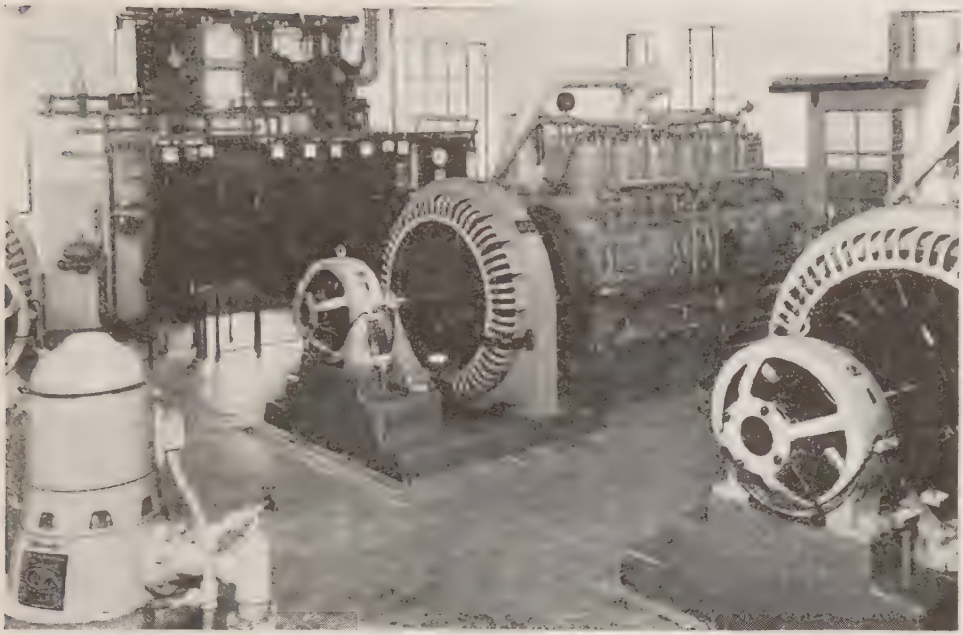
STOCKPORT. — An engine of double cylinder design, the Stockport engine operates on the Otto cycle, the cylinders being located on opposite sides of the shaft. Either city gas (600 to 650 B.T.U. per cubic foot) or producer gas (160 B.T.U. per cubic foot) may be used as fuel. The ignition is electric; a small magneto-electric generator is placed over and worked from the camshaft of the engine. A cast-iron plug is fitted to the combustion chamber, and in this there are two spindles—one fixed and insulated, and connected directly to the electric generator; the other constructed so as to revolve. At the moment when a spark is required a cam on the side shaft releases a lever, which strikes one of the spindles, breaking contact and causing a spark. Provision is made for altering the time of the spark when starting the engine. A special form of trunk piston is used, in which the spring rings are separated by loose intermediate or junk rings, and the whole held in place by junk covers. This form of double-cylinder engine is much used. The exhaust valves work vertically and are water cooled.

BRUCE-MACBETH.—One of the most successful of modern Otto cycle gas engines is the Bruce-Macbeth, available in two and four cylinder units of from 40 to 400 brake-horse-power. All valves are fitted with removable guides; the intake valves seat directly against the cylinder head, the exhaust valves on removable and renewable alloy steel seats. Pistons are fitted with three compression rings and one oil-retention ring. Easy inspection and adjustment within the crankcase is facilitated by hinged doors on the side of the case. Two full jump-spark ignition systems are provided, either of which will operate the engine. The Bruce-Macbeth engine is started by compressed air, admitted to each cylinder in firing order. A wide range of fuels may be used, from low grade producer gas of 125 B.T.U. through the various types of city and natural gas to butane and propane at caloric values in excess of 3,000 B.T.U. per cubic foot.

The HERCULES, LYCOMING, WAUKESHA, WORTHINGTON, AND COOPER-BESSEMER are other modern gas power units, chiefly used on jobs requiring a steady flow of power, such as pumping, refrigeration, air-conditioning, and the generation of electric power.

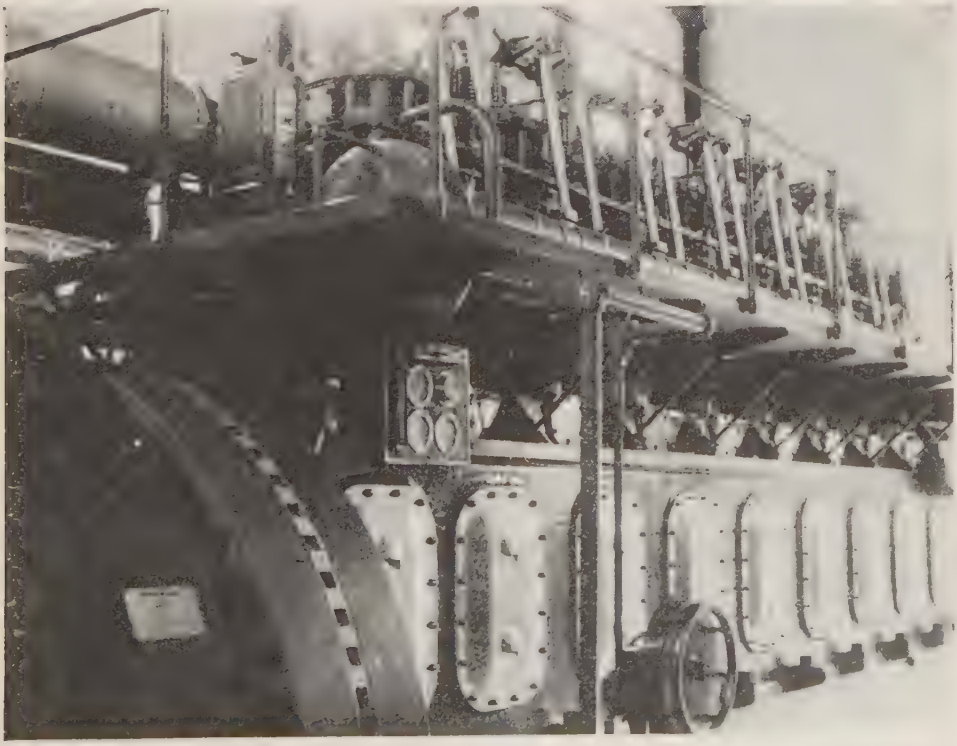
The Gas Engine in Industry. —The principal factors to consider in selecting a gas engine as a prime mover are speed (revolutions per minute or piston speed) and horsepower output; both are of the utmost importance, since together they determine the efficiency of the engine; it is necessary to decide whether both are consistent with the specific duties expected of the engine. Piston speed is ordinarily expressed in *feet per minute* and is determined from the product of the stroke in inches x 2 x R.P.M., divided by 12. Horsepower is usually rated by gas engine manufacturers at Piston speeds of 1000 feet per minute. The more rigid the crank shaft, the greater the bearing surface, the lighter the reciprocating parts (pistons, connecting rods, etc.), and the more effectively these parts are balanced in rotation, the higher the rotative speed can be. Horsepower of an engine varies approximately in direct ratio to the speed. Consequently, in slow running engines, there is no economy to be gained in operating at too low a speed, thus increasing the first cost per horsepower of the engine. Though primarily designed for long hours of low-speed service, gas engine speed may be increased, provided the period of operation is not too long, as in the operation of drags, hoists, elevators, etc., where the higher speed is generally for short periods and usually with a light load. Stand-by service is another instance where higher speed may have favorable consideration for the reason that such service usually requires but a few hours of operation per year.

A gas engine obtains its power from the expansion of the products of combustion, produced by the burning of the fuel in the combustion chamber or cylinder of the engine; the more fuel that is being burned, the more power developed. The heat supplied to a gas engine as fuel is balanced approximately as follows: Useful Work (25%), Friction (7%), Jacket Water (30%), Exhaust (35%) and Radiation (3%). Horsepower is also dependent on the amount of heat that can be dissipated through the exhaust valves and into the cooling system through the cylinder walls. Consequently, consistent overloading of the engine usually results in a diminution of power and expensive replacements of scored cylinders and burnt valves, a condition that may be partially avoided by an adequate cooling system.



Courtesy Atlanta Gas Light Co., Atlanta, Georgia

NATURAL GAS ENGINES DRIVE GENERATORS FOR POWER AND LIGHT



Courtesy Lone Star Gas Co., Dallas, Texas

WORTHINGTON 8-CYLINDER NATURAL GAS ENGINE OF 1000 H.P. DRIVING A 1000 K.V.A. ALTERNATOR

Considerable variation exists in the various phases of gas engine operation. Air and gas entering the engine must be mixed in correct proportion for maximum results; three general types of mixers are in use: the *mechanical*, the *vacuum*, and the *venturi*, the last proving to be the most popular and efficient type. Ignition may be provided by *battery system* or by *high tension magneto;* all gas engines of 5 inch bore or over use magneto ignition, as do many of the smaller power units. The four general methods of starting a gas engine are *hand cranking, battery, auxiliary gas engine,* and *compressed air,* the first being used only on smaller engines. The lubrication of a gas engine corresponds closely to that of any automobile engine, oil being kept free from sludge and fine particles of grit by frequent oil changes and the installation of filters and dry pumps, which tend to eliminate water vapor. Of utmost importance is the cooling system, for upon its operation depends the success or failure of any internal combustion engine. The simplest cooling sytem is one in which the water, after passing through the engine, is carried off as waste. Unfortunately, soft water is not often available in such quantities and must, therefore, be used over and over. The methods most commonly used in cooling water from the engine are the *spray pond,* where hot water is sprayed and cooled by evaporation and the cooling tower, where *atmospheric cooling* or *mechanical forced draft cooling* take place.

During recent years, many used automobile engines have been installed for operation on natural gas, the only important alterations being in the cooling system and in the substitution of a mixer for a carburetor. Similarly, in many sections of the country where natural gas exists, gas-Diesel combination engines have been installed. These units, which may be changed over from one fuel to the other in a few hours, deliver about 10 per cent less power on gas fuel than on oil. Gas engines have a number of advantages over Diesel engines, chief among them being less weight and bulk, less wear, less maintenance cost, better lubrication, and longer life. On the other hand, fuel costs are usually higher for gas engines than for Diesels.

See Oil and Gasoline Engines; Diesel Engine; Motor Boats; Motor Cars; Fuels.

Consult Collins' *Gas, Gasoline and Oil Engines* (1919); Okill's *Internal Combustion Engines* (1922); Degler's *Diesel and Other Internal Combustion Engines* (1936); C. F. & E. S. Taylor's *The Internal Combustion Engine* (1938); Degler's *Internal Combustion Engines* (1938); Lichty's *Internal Combustion Engines* (1939); American Gas Association's *Gas Engine Handbook.*

Gases. A gas is an invisible, transparent substance of low specific gravity, offering little resistance to the passage of bodies at low speed through it. An example is *air*, which is a mixture of a number of gases, principally nitrogen, oxygen, water vapor, argon, and carbon dioxide. A gas expands indefinitely in all directions; hence has no inherent bounding surface, and must be completely enclosed, and is said to exert pressure.

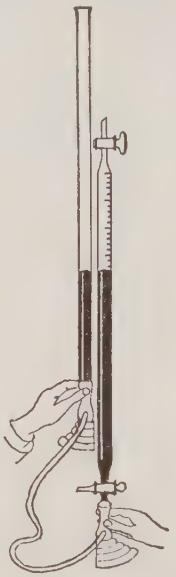


Fig. 1.—*Hempel Gas Burette.*

Most gases are colorless; some are colored, as chlorine (greenish yellow). Many have characteristic odors, as ammonia; some are odorless, as hydrogen. Considerable diversity of physiological effect is shown among gases. Some are indifferent, as nitrogen; some irritating, as sulphur dioxide (formed when sulphur burns); some anesthetic, as nitrogen monoxide (laughing gas); some poisonous, as carbon monoxide; while oxygen is necessary for the maintenance of life processes.

Chemically, gases may be elementary, as oxygen, or may be compounded of two or more elements, as carbon dioxide. They may react with each other, as hydrogen chloride and ammonia when brought in contact, forming ammonium chloride (sal ammoniac); or with other suitable chemical reagents, as burning sulphur, which is the chemical union of sulphur with the gas oxygen, forming sulphur dioxide. They are frequently formed in the reactions of other substances, as when marble is brought in contact with an acid, the gas carbon dioxide is generated—evidenced by the formation of bubbles (effervescence).

Gases dissolve in, or mix with, each other in all ratios, but dissolve in some liquids and solids in ratios distinctive for each solvent. Thus, one litre of water at 0° c. will dissolve 48.90 c.c. of oxygen, and one cubic centimeter of platinum black will dissolve 310 c.c. of hydrogen.

When not very soluble in water, gases are conveniently collected or transferred from one vessel to another in a pneumatic trough (q. v.). If soluble in water, they may be collected similarly over mercury, unless they react chemically with the mercury. They may be measured by enclosing them in a burette such as that of Hempel (Fig. 1). A gas may be weighed by weighing an evacuated glass bulb of known capacity, and weighing the same bulb filled with the gas; the difference is the weight of the gas.

Many liquids and solids may be converted into gases by application of heat, by diminution of pressure, or by both; hence substances which have an appreciable vapor pressure at the prevailing temperature will be present in the gaseous state. If the substance is in a closed vessel, evaporation will take place until the pressure of the enclosed vapor equals the vapor pressure of the substance. Thus, water at 20° c. has a vapor pressure of 17.36 mm. If, therefore, a vessel is partially filled with water at 20° c. and closed, water vapor will form until it has a pressure of 17.36 mm. If the substance is not enclosed, but left exposed, it will in time entirely disappear, having all assumed the gaseous state. Thus, a cloth wet with water and hung up dries, and a lump of camphor disappears.

The effect of increasing the temperature of a gas is to increase its volume, or expand it; while decreasing the pressure to which a gas is subjected decreases the volume, or contracts it. Hence, in stating the volume it is always necessary to mention the temperature and pressure at which the given mass of gas occupied the stated volume. For sci-

entific purposes the temperature 0° C. (at which ice melts) and 760 mm. (about the average barometric pressure) are taken as standard conditions to which to refer gases for measurement. The complete statement as to variation of volume, with changing conditions of temperature and pressure, will be found under GASES, LAWS OF.

Among the many physical constants pertaining to gases, which serve to distinguish them, density and specific gravity are in frequent use.

The *absolute density* is the weight of one cubic centimeter at 0° C. and 760 mm. Thus, hydrogen, 0.00008986 G. The *relative density* is the ratio of the weight of a given volume at 0° C. 760 mm., to an equal volume of hydrogen at the same temperature and pressure. Thus, one litre of oxygen at 0° C., 760 mm., weighs 1.4293 G., and one litre of hydrogen at 0° C., 760 mm., weighs 0.08986 G. The relative density of oxygen is therefore $1.4293 / 0.08986 = 15.91$.

The *specific gravity* is the ratio of the weight of a given volume at 0° C., 760 mm., to the weight of an equal volume of dry air at the same temperature and pressure. Thus, one litre of air at 0° C., 760 mm., weighs 1.293 G. The specific gravity of oxygen is therefore $1.4293 / 1.293 = 1.105$.

LIQUEFACTION OF GASES.—An apparatus for the liquefaction of gases, as that devised by Andrews, may consist of a compression tube, the upper part of which is of glass, in which the gas experimented on, as carbon dioxide, is enclosed, and which can be surrounded by a bath to maintain any desired constant temperature. The lower part of the tube may be of iron, completely filled with water, and a steel screw is screwed into the bottom to produce any pressure up to 400 atmospheres. The gas is separated from the water by a short thread of mercury, and the position of the mercury indicates the volume V of the gas. The pressure, P, is measured by observing the volume of a quantity of air contained in a precisely similar tube connected with the first. As the compressibility of air is known from previous researches, the apparatus is capable of determining the isothermals for carbon dioxide—*i.e.*, the relation between P and V at any desired temperature, namely, that of the enclosing bath.

The relations between pressure, volume, and temperature are shown by the diagram (Fig. 2). At 50° C, the curve (9) is fairly uniform, approximating a rectangular hyperbola, the curve given by the more perfect gases, such as air, oxygen, hydrogen, etc. No liquefaction takes place, or

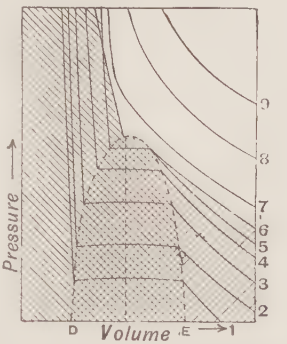


FIG. 2.—*Curves Showing Relation of Pressure and Volume.*

could take place, no matter how much the pressure might be increased. At a temperature of 31° C. (curve 6) an unmistakable bend takes place, and the gas just escapes liquefaction. This is the *critical temperature* for carbon dioxide. At lower temperatures, as 5° C., liquefaction just begins to set in at the point E. From this point, so long as the temperature remains constant, no increase of pressure can take place (Dalton's law for saturated vapors). The condensation goes on, therefore, along a horizontal line, till at the point D the substance is all liquid. A liquid is highly incompressible, and so from this point the curve rises very steeply.

The area can be divided into four regions, indicated by the various shadings. Lines sloping downward from left to right indicate the liquid state; upward from left to right, vapor. We see, therefore, that there is a cross-hatched region in which liquid and vapor exist in equilibrium. The volumes indicated by the points D and E are the volumes of the substance as liquid and vapor respectively. They are considerably different at this temperature, but at higher temperatures they become more nearly equal, till at the critical temperature the volumes of the substance as liquid and vapor are equal—*i.e.*, the densities are equal—and the liquid and vapor need not separate, but either might float in the other.

This may be observed in an experiment first devised by Cagniard de la Tour, in which a stout-walled glass tube is two-

PROPERTIES OF COMMON GASES.

Name.	Color.	Odor.	Absolute Density (grams).	Specific Gravity (air = 1).	Solubility in Water.[1]	Symbol.
Acetylene	Colorless.	Ethereal.	.001162	.92	1.21	C_2H_2
Air	Colorless.	Odorless.	.001293	1.0000	.02168	.....
Ammonia	Colorless.	Pungent.	.0007621	.5971	846.5	NH_3
Argon	Colorless.	Odorless.	.001782	1.379	.041	A
Carbon dioxide	Colorless.	Odorless.	.001965	1.529	1.075	CO_2
Carbon monoxide	Colorless.	Faint.	.001251	.9672	.02683	CO
Chlorine	Yellowish green	Pungent.	.003167	2.491	2.780	Cl_2
Fluorine	Lt. greenish yellow.	Penetrating.	.001697	1.26	.....	F_2
Helium	Colorless.	Odorless.	.0001787	.1368	.01473	He
Hydrogen	Colorless.	Odorless.	.00008986	.06960	.02008	H_2
Hydrogen chloride	Colorless.	Pungent.	.001628	1.269	483.5	HCl
Hydrogen sulphide	Colorless.	Fetid.	.001523	1.189	3.224	H_2S
Krypton	Colorless.	Odorless.	.003654	2.818	.....	Kr
Methane	Colorless.	Odorless.	.0007160	.5576	.0389	CH_4
Neon	Colorless.	Odorless.	.000893	.674	.....	Ne
Niton	Colorless.	Odorless.	.....	.....	.....	Nt
Nitrogen	Colorless.	Odorless.	.001254	.9674	.01884	N_2
Nitrogen dioxide	Colorless.	Unknown.	.001342	1.039	.05430	NO
Nitrogen monoxide	Colorless.	Faint.	.001969	1.530	.7782	N_2O
Nitrogen tetroxide	Red brown.	Pungent, irritating.	.004113	3.181	.....	N_2O_4
Oxygen	Colorless.	Odorless.	.001429	1.105	.03603	O_2
Ozone	Colorless.	Penetrating.	.002144	1.658	.51	O_3
Sulphur dioxide	Colorless.	Pungent, suffocating.	.002861	2.264	49.88	SO_2
Xenon	Colorless.	Odorless.	.005717	4.422	.....	Xe

[1] Volumes at 15° C., 760 mm., dissolved by 1 volume water.

Gases

thirds filled with liquid sulphur dioxide and sealed up; the space above the liquid is filled with the gas. If then the tube is heated up in a bath of a liquid like glycerin, the liquid sulphur dioxide will be seen to expand until the critical temperature (156° C.) is reached, when the meniscus dividing the gas from the liquid becomes indistinct and disappears. At the same time striæ are seen in its place, but they soon vanish, and the contents of the tube become homogeneous. On reversing the process by cooling the tube, a sort of shower appears in the upper part, and the meniscus is re-formed.

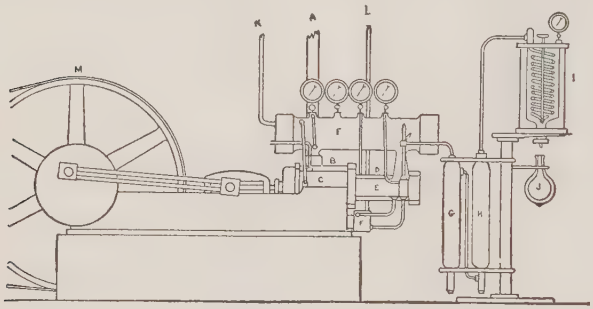


FIG. 3.—*Liquid Air Machine.*

A, Intake; B, compression of cylinder to 100 lbs. per sq. in., C, to 200 lbs., D, to 1,000 lbs., E, to 3,000 lbs.; F, F, intercoolers; G, water and oil drip; H, potassium hydroxide; I, Linde liquefier; J, Dewar flask; K, inlet water-cooling system; L, outlet water-cooling system; M, belt from motor or power shaft.

We may therefore gather that above a certain temperature a gas is incapable of liquefaction. The volume might, by increased pressure, be made smaller and smaller (even less than that which the substance might have in the liquid form), but the separation of liquid would not take place. It is a true or 'permanent' gas above this temperature; while below, it is a vapor, sufficient pressure only being required to produce liquefaction.

Thus a gas may be liquefied when its temperature is below its critical point, if it is subjected to those conditions that cause the condensation of any vapor. These conditions are simply that the external pressure should be larger than the vapor pressure of the liquid; a state of affairs that can be attained in two ways—*viz.*, by increasing the external pressure by compression pumps, or by decreasing the vapor pressure by cooling.

According to these principles, gases of which the critical point is above ordinary temperatures can be liquefied by compression alone, though the pressure required may be reduced by cooling; while those of low critical point must be cooled, and are usually liquefied at atmospheric pressure. Thus Faraday, who was the pioneer in this field, liquefied the more easily condensible gases by the first method, making the gas in a closed Λ-shaped tube, so that the pressure caused by its evolution, aided by the cooling of one limb of the tube in a freezing mixture, was sufficient to bring about its condensation. The method was much elaborated by Pictet, who produced a considerable lowering of temperature by the successive liquefaction and evaporation of the more easily condensible gases, such as sulphur dioxide and carbon dioxide, and at the boiling point of the latter, under reduced pressure, succeeded in effecting the liquefaction of oxygen. The method of compression is still used for the commercial preparation of liquid sulphur dioxide, carbon dioxide, nitrous oxide, etc., which are sold as liquids in strong steel cylinders.

The production of the gases that are with the greatest difficulty liquefied, even in large quantity, has been effected within the last fifteen years by the application of a discovery of Joule and Lord Kelvin, also of a thermo-dynamical character, that when a gas is forced through a small aperture or porous plug it is perceptibly cooled. The effect known as the Joule-Thomson effect is small, being only .25° C. for air at ordinary temperature, with a difference of 1 atmosphere pressure on each side of the aperture; but as it varies directly with the difference of pressure, and inversely as the square of the absolute temperature, it is much more effective the lower the temperature and the greater the pressure.

Apparatus on this principle has been devised by Linde on the Continent and Hampson in England, in which the effect is combined with the regenerative principle—*i.e.*, the cooled gas passes out alongside the entering gas, so that the latter is cooled to the temperature of the former. The temperature of the expanding gas thus becomes lower and lower, until liquefaction takes place, at a pressure only very slightly above that of the atmosphere. The apparatus itself is of the simplest description, compressed purified air furnished by a pump, or even a cylinder of compressed air, being led through spirals of copper tube wound co-axially round a central spindle that controls the opening of the jet at which the compressed air escapes. After expansion the cooled air flows out either over the outside of the spirals, or through concentric ones, cooling the incoming gas so effectually that the final temperature of the escaping gas is only a degree or so lower than the temperature of that entering. When the temperature at the jet reaches the liquefying point, a large proportion of air liquefies, trickles down, and is collected in

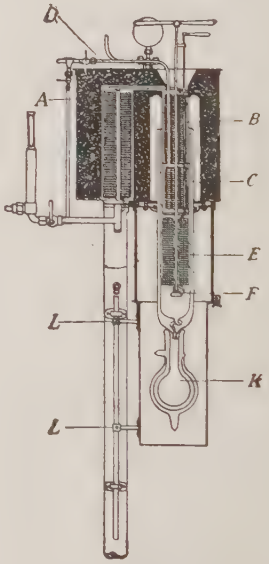


FIG. 4.—*Travers' Hydrogen Liquefier.*

A, Chamber cooled by hydrogen returning to gas holder; B, chamber filled with liquid air; C, chamber in which liquid air is evaporated rapidly; D, pipe to exhaust pump; E, regenerator coil; F, escape valve for the compressed hydrogen; K, vacuum vessel; L, slide for lowering box containing the receiver.

Gases, Kinetic Theory of

a 'vacuum vessel,' or vessel with double walls, from between which the air is exhausted as perfectly as possible. By working in this way, with a three-horse-power motor driving the compression pumps that deliver the air at 170 atmosphere pressure, liquid air is obtained in about four minutes, at a rate of about 1 to 1½ quarts per hour.

With hydrogen the Joule-Thomson method does not cause cooling of the gas at ordinary or even much lower temperatures, and it is only when the gas is cooled to well below —80° c. that the method is really effective. It is carried out by cooling the hydrogen, first by a freezing mixture of solid carbon dioxide and alcohol, and then by liquid air, boiling under reduced pressure, so that it reaches —200° c., and then expanding it in an apparatus similar to that used for air, when it liquefies in the same manner. By evaporating liquid hydrogen it is possible to produce the lowest temperatures known, and thus to liquefy or solidify those gases which can only be obtained in small quantities, or, like fluorine, are of a very corrosive nature. Liquid hydrogen has also been suggested as a means of producing high vacua, the air in the vessel to be exhausted being condensed in a portion that can be sealed off before it is removed from the cooling influence.

Consult Hardin's *Rise and Development of the Liquefaction of Gases;* Travers' *Study of Gases;* Dewar's Lectures (in *Proceedings of the Royal Society*, 1878 to date).

Gases, Kinetic Theory of. In order to account for the pressure which a gas exerts on the walls of the containing vessel, it used to be thought necessary to suppose that the molecules of which the gas was composed were endowed with mutually repelling molecular forces, or behaved like india-rubber balls packed into a bag, compressing one another, and so giving the equivalent of repelling forces.

It was first pointed out by Hooke that motion of small particles could account for pressure. Imagine a target hung by the upper edge to be struck by a projectile. The target would sustain an impulse equal to the momentum of the projectile if it fell dead after striking, or twice this if it rebounded with perfect elasticity. The target would show a ballistic deflection, and would then swing back toward its position of rest. But imagine a rapid succession of impulses, very numerous, but none of them very violent; then a steady deflection would be shown by the target, precisely as if it were acted on by a constant force, such as that produced by a current of air. The amount of the pressure would be the sum of all the impulses occurring per second per unit of area.

If we assume certain simplifications, it is possible to develop this line of argument so as to obtain a very simple form of the fundamental equation. Molecules will impinge on one another as well as on the sides of the vessel, and a certain distance will be travelled between the collisions. The average distance is called the *mean free path.* (1) Assume that the size of the molecules is negligible, at least in comparison with the mean free path. (2) Assume that intermolecular forces are negligible, at least in comparison with the effects of velocity. (3) Assume that the molecules act as perfectly elastic bodies. These are the conditions for the 'perfect gas'; but in actual gases only the third assumption can be strictly realized.

Since, when two bodies impinge, the momentum lost by the one is communicated to the other, there will be no error in thinking of the molecules as simply passing through one another without collision. Further, the pressure at a point in a gas will not be changed if we suppose an imaginary sphere with an infinitely thin, rigid boundary drawn round the point. Suppose a single molecule of mass m and velocity v to impinge on the surface and rebound with the same velocity. If it struck normally, the impulse would be $2mv$ (dynamics); but if obliquely, the fraction $\frac{d}{r}$ of the normal impulse will represent the impulse on the surface. It will then travel the distance AB (= $2d$) between successive impacts, and will impinge, therefore, $\frac{v}{2d}$ times per second. The total impulse per second due to this molecule is thus the product of these last three quantities—*i.e.*, $\frac{mv^2}{r}$. Dividing by the area of the spherical surface $4\pi r^2$, we obtain $\frac{mv^2}{4\pi r^3}$. If v be the volume of the sphere $= \frac{4}{3}\pi r^3$, we may write this as $\frac{1}{3}\frac{mv^2}{v}$, the pressure due to a single molecule. If there be n molecules in the sphere, all of equal mass, the total pressure p is n times this—*i.e.*, $\frac{1}{3}\frac{mnv^2}{v}$ (1). v^2, however, will be different for different molecules, and therefore the v^2 which occurs in this final result must be understood to be the average of v^2 of all the different molecules. v^2 is, in fact, what is

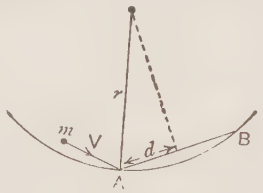


Diagram of Kinetic Theory of Gases.

called the *mean square speed.* Now mn is the total mass M of the gas present, and the above may be written $p = \frac{1}{3}\frac{M}{v}v^2$ (2). Again, $\frac{M}{v}$ is the density δ, so that we have a still simpler form for the equation—*viz.*, $p = \frac{1}{3}\delta v^2$ (3). Lastly, this equation may be written $pv = \frac{1}{3}Mv^2$ (4), or $pv = \frac{1}{3}mnv^2$ (5). These various forms of the fundamental equation provide the means of deducing many interesting results.

For instance, taking form (3), if the density of a gas at a given pressure be known, the mean square speed for the gas can be calculated at the temperature to which the data refer. Thus for hydrogen at 0° c., and pressure 760 mm. of mercury, or 1,014,000 dynes per sq. cm., the density is .0000896, and consequently v = 184,000 cm. per second. In hydrogen at 0° c. the mean square speed of the molecule is about 1,840 metres per second—*i.e.*, between five and six times the speed of sound in air. By theoretical and experimental investigations it has been shown that for hydrogen at 0° and 760 mm. pressure the mean free path is .000185 mm., and the number of collisions per second 9,480 millions for a single molecule. Further, if we compare the equations for this theoretical gas with laws discovered experimentally for actual gases, we find (1) an interpretation of the idea of temperature, and (2) an explanation of other gas laws.

Boyle's Law.—(*a*) For actual gases. For a given mass of a gas pv is constant if the temperature is constant, no matter how p or v may vary. (*b*) Compare the law for the theoretical gas as expressed by form (4). For a given mass (M) of a gas, pv is constant if v is constant. Thus, constant temperature in a single gas means constant v.

Charles' Law.—(*a*) For a given quantity of any specified gas the product pv increases by equal amounts if the temperature

Gases, Kinetic Theory of

increases by equal steps. (*b*) Form (5). For a given number of molecules (n) of a specified gas pv increases by equal amounts if mv increases by equal amounts. Thus, equal steps of temperature correspond to equal increments of mv^2 or of the average kinetic energy. This leads to the idea of an 'absolute zero of temperature,' when the molecule has no velocity and the gas would exert no pressure on the sides of the vessel. We may indeed define temperature as proportional to the kinetic energy of the molecule; and this would be an absolute scale of temperature, as it would be the same for all perfect gases, no matter what the size of the molecule.

AVOGADRO'S LAW.—(*a*) In equal volumes of different gases at the same pressure there are the same number of molecules, if the temperatures are the same. (*b*) Form (5). Let the gases be denoted by 1 and 2. Then we have $p_1v_1 = \frac{1}{3}m_1n_1V_1^2$, and $p_2v_2 = \frac{1}{3}m_2n_2V_2^2$ Hence for equal values of v and of p the values of n are the same, if the values of mv^2 are the same. Consequently, in different gases at the same temperature the kinetic energies of the molecules are the same. Here this fact has been deduced from Avogadro's law; but it can be proved from mechanical principles; and by reversing the reasoning, this law may be made to depend on it.

DALTON'S LAW.—In a mixture of two or more gases the total pressure is equal to the sum of the 'partial pressures' which each constituent would have produced had it been present alone in the space. This holds only if the attractive force between the different molecules is negligible. If, as already assumed, the total pressure would be the same when instead of colliding the molecules pass through each other, this law becomes self-evident. Adopting the above notation, we have $p = p_1 + p_2 = \frac{1}{3}m_1n_1V^2 + \frac{1}{3}m_2n_2V_2^2$; and since the temperatures of the constituents must be the same—*i.e.*, $m_1V_1^2 = m_2V_2^2$—this admits of the simplification $p = \frac{1}{3}mV^2(n_1 + n_2)$. Thus, if the number of molecules in a space be increased at constant temperature, the pressure increases in proportion to the total number, whether they are similar or not.

When we attempt to account for the discrepancies which occur between the behavior of the theoretical gas and the behavior of actual gases, we must take into account assumptions (1) and (2) made in defining the perfect gas. This has been done with considerable success by Van der Waals. (1) If the molecules are of a non-negligible size, the actual volume moved through by the molecules is less than v by a constant amount b. (2) If intermolecular forces are not negligible, then velocity has to account not only for the pressure p on the sides of the vessel, but also for the overcoming of these forces; and this addition can be easily shown to take the form $\frac{a}{v^2}$, where a is a constant. The corrected equation for Charles' law consequently takes the form:

$$\left(p + \frac{a}{v^2}\right)(v - b) = \text{RT}.$$

This cubic equation supplies some remarkable results. It gives isothermals for a gas similar to those obtained by Andrews for carbon dioxide, and in the case of liquefaction for a vapor it gives the peculiar theoretical form predicted by James Thomson. Further, it is possible by three observations of the pressure, volume, and temperature of a gas, to obtain the constants a, b, and R, and hence to deduce the forms of the isothermals and the critical temperature and pressure, with in many cases a considerable degree of accuracy.

LIQUIDS AND SOLIDS.—In order that the kinetic theory may be extended to the explanation of phenomena in liquids and solids, the action of attractive forces between the molecules must be considered. The fact that in the formerly so-called 'permanent' gases the deductions from the gas laws already described have been so small, shows that attractive forces are to a first approximation negligible. This may be explained by supposing that the so-called centrifugal effect of great speed counterbalances attractive forces. This supposes comparatively great speeds, and will be altered if these be diminished by cooling the gas, or if attractive forces be made more effective through molecules being brought on the average closer together, as when the density is increased by great pressure. These means, cooling and compression, are the two great agents for the liquefaction of gases.

When a gas or a vapor becomes sufficiently cooled, therefore, molecular attraction becomes more important. Molecules which impinge may remain in contact so that their freedom of motion is greatly curtailed. This is the process of condensation; and the liquid formed is denser, and settles down to the bottom of the enclosing vessel. The process does not go on without limit, but reaches a steady condition of equilibrium. The matter may be illustrated by the analogy of a crowd in an enclosure divided by a straight line into two compartments L and V. Suppose, further, that in the V compartment perfect freedom of motion is allowed, but that in the L compartment the rule prevails that two individuals who come into contact must remain together for one minute before separating. It will be obvious that the chance of a molecule crossing the boundary from V to L is much greater than the chance of a molecule crossing from L to V. Consequently in the L region there will be an accumulation of molecules, greater density, and in the region V a smaller density—the smaller number of molecules compensating for the greater freedom of motion.

Cooling the vessel and its contents makes the speed of the molecules less. In the analogy it corresponds to increasing the time from one minute to (say) two minutes. Consequently a smaller density in the V region will suffice to maintain equilibrium—*i.e.*, to get as many molecules across the boundary into the L region as come across from the L region to the V. Hence one can understand in a rough way why to every temperature there corresponds a definite vapor density (and also a definite vapor pressure), so long as some liquid is present.

If there were in the enclosure a number of other neutral individuals incapable of entering the L enclosure, it is obvious that they would not affect the final result. Their presence would not enable a smaller density of V molecules to maintain equilibrium; they would simply impede by their presence the process of arriving at equilibrium. This enables us to add to the law expressed at the end of the last paragraph the words, 'even though another neutral gas be present; but the total pressure will be the sum of the pressure of the vapor depending on temperature alone, and the pressure of the gas depending on the temperature and volume according to Charles' law.' This completes the expression of Dalton's law for saturated vapors.

In a liquid a molecule has a certain freedom of translation, and diffusion does take place. Thus, if water be placed over a solution of salt (preferably colored, as copper sulphate) in a place where temperature inequalities do not produce convectional disturbances, it will be found that in time the salt will work upward and the water

Gases, Laws of

downward; but the process takes years to produce an amount of mixture which with two gases would take place in a few seconds. In solids the freedom of translation of the molecule is almost absent. They are settled down to fairly constant positions of equilibrium in crystals—probably in some simple geometrical groupings, such as is realized by the centres of a pile of cannon balls. They are not in contact, and may vibrate toward and away from one another; and if a molecule be compound, it may have vibrational movements within itself. It may also have rotational energy. That they are not in contact is shown from the fact that a body can be compressed, and that it contracts with cooling. (See ATOM.)

That translational energy is not altogether absent in solids is shown by an experiment of Roberts-Austen. He laid a piece of gold leaf on a freshly cut surface of lead, and after some years the gold had disappeared. By cutting off thin layers of lead and analyzing them he found that the gold had penetrated to the extent of several millimetres. So that diffusion is not altogether absent in solids.

The complete theory of the subject involves the use of the most abstruse mathematics. An elementary treatment will be found in Edser's *Heat for Advanced Students*, and in the larger text books of heat, such as Preston's; or of physics, such as those of Watson or Müller-Pouillet; or of physical chemistry, as Walker, Ostwald, or Van't Hoff. Special books, such as Meyer or Burbury, can only be read by accomplished mathematicians; but an exception is Risteen's *Molecules and Molecular Energy*. A treatment by elementary mathematics is also found in Clerk-Maxwell's *Heat*.

Gases, Laws of. The most important laws of gases are those which relate to the effects on them of pressure and temperature changes. Two peculiarities characterize gases in this respect: (1) When a given quantity of gas is brought to a definite pressure and temperature, there is no ambiguity as to its other properties, as, for instance, volume, internal energy, entropy. (Contrast the case of a piece of iron, which may under the same pressure and temperature, be hard drawn, annealed, magnetized, or otherwise different as regards its internal properties.) (2) Gases are extremely susceptible to changes of volume under the effects of increase of pressure, or temperature. In other words, their compressibilities and coefficients of expansion are relatively very great.

BOYLE'S LAW.—Since gases must be always contained in a closed vessel, if changes of volume are to be studied the vessel must be closed by a movable piston or plug; and for this purpose mercury is eminently suitable, as it also provides an easy means of varying pressures. The apparatus shown in Fig. 1 is that by which Robert Boyle, in 1662, proved the important law known in Great Britain by his name, though also known as Mariotte's law. It consists of a glass tube, fastened to a support. The gas is imprisoned in A D by the mercury (which is poured in at B). Its volume A, and pressure AE, in centimeters of mercury, say, are easily read off on the scale attached. If mercury is added till the pressure—the difference in levels AE—becomes doubled, it will be found that the volume is halved; in other words, the volume V of a gas varies inversely as the pressure P; or, P × V is constant (at constant temperature)—these alternative statements being known as Boyle's Law.

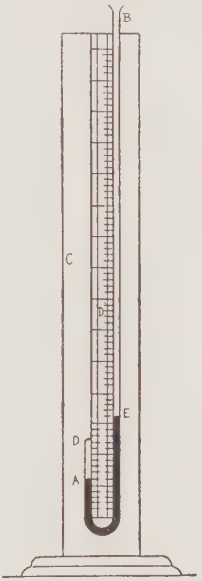


FIG. 1.—*Boyle's Law Apparatus.*

If the law were quite strict, the curves of the product P × V against P (shown in Fig. 2) ought to be a horizontal straight line. That would mean that by increasing the pressure sufficiently the volume of a gas could be diminished without limit. But, in fact, in the case of every gas under increasing pressures (at least when these become great enough), the volume remains larger than is required by the law. In other words, the value of PV increases with increasing pressure, or the curve slopes upward to the right. For all gases except hydrogen the curve dips down at first. This dip is most marked with gases at temperatures little over their critical point, as, for instance, carbon dioxide, and less and less marked as the temperature is raised. This seems to suggest the inference that at temperatures which are high enough every gas would show a deviation like that exhibited by hydrogen. The results shown in Fig. 2 have been obtained by Amagat, working to pressures of 300 atmospheres, but for ordinary pressures the deviations are very small. Thus, for air up to 12 atmospheres the value of PV only decreases by about .6 per cent. over the whole range, and the deviation for nitrogen is about the same. For carbon dioxide, on the other hand, the corresponding amount is 15 per cent. decrease.

For convenience in calculations, Boyle's Law may be symbolized thus: let p = the given pressure; p' = changed pressure; v = volume at pressure p, and v' = volume at pressure p'. Then $pv = k$ (a constant), and $p'v' = k'$ (a different constant). For moderate pressures, $k = k'$ very nearly. Hence $pv = p'v'$, or $v' = pv\ p'$.

CHARLES' LAW.—The effect of temperature change on a gas may also be studied by means of the apparatus figured in reference to Boyle's Law, if we replace the shorter limb of the tube AD by a bulb, enclosed by a bath capable of being heated. We find that the expansion of the gas which takes place has a twofold aspect—a change of volume as the mercury at A is forced down, and a change of pressure consequent on the change of levels.

It is inconvenient to consider these two changes simultaneously at first, and so we may imagine mercury removed or added so as to restore either (1) the original pressure—*i.e.*, the same difference of levels AE; or (2) the same volume AD. Thus, we consider a rise of temperature as having the effect of either (1) increasing the volume at constant pressure, or (2) increasing the pressure at constant volume. If we take the first case, and work between the temperatures 0° and 100° C., the results when plotted will give the full straight line in the accompanying diagram (Fig.

Gases, Laws of

3). The increase of v per degree is a constant quantity, and $2\frac{1}{3}$ of its value at 0°. If the experiments were continued below 0°, we should obtain simply the dotted continuation, indicating continually decreasing volumes. If we produce the line to cut the temperature axis, we find the theoretical temperature (− 273° C.) at which the volume of the gas would come down to zero (*i.e.*, supposing the law to hold at such low temperatures). There can be no lower temperature than this, for there can be no smaller volume than zero; so this temperature may fairly be called the absolute zero of temperature.

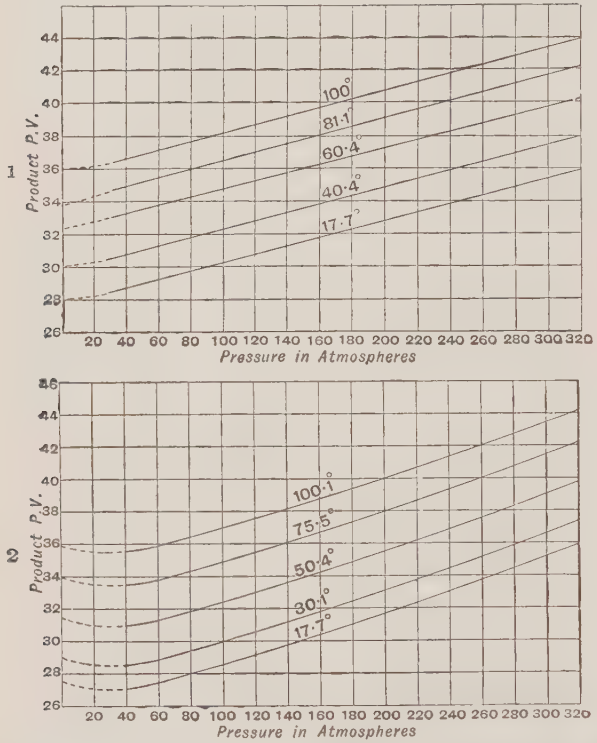


FIG. 2.—*Amagat's Curves for (1) hydrogen and (2) nitrogen. The dotted lines represent subsequent extensions of Amagat's results.*

On the other hand, if we experiment at *constant volume* and plot pressures, we get a precisely similar law, and practically the same point for absolute zero. From this point of view, the absolute zero is that temperature at which the pressure of all gases would be zero.

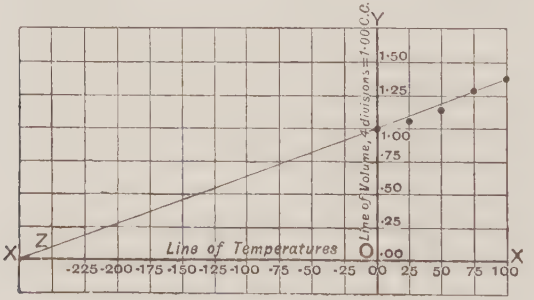


FIG. 3.—*Charles' Law.*

Neither process of reasoning is quite convincing; for though it is possible to think of gas molecules inert and exerting no pressure, it is difficult to conceive matter occupying zero volume. Again, the regions of temperature in the neighborhood of the absolute zero are but little explored as regards the effect on the volume of a gas. Such evidence as there is points to alterations in the rate of contraction, thus bringing the zero to another position; but be this as it may, there is excellent evidence deduced from thermodynamical principles that a body at a temperature within a fraction of a degree of − 273° C. would be without heat, and so at the absolute zero of temperature. We may therefore conclude that if we could deal with a 'perfect gas,' of which the molecules were but centres of force and without attractive action on each other, such a gas would be reduced to zero volume and pressure at − 273° C.

If we call temperatures centigrade t, and agree to call temperatures measured from − 273° C. absolute temperatures ($T = t + 273°$), it is obvious that the ordinates in the diagram are proportional to absolute temperatures. The two laws above may be stated as follows: The volume of a gas at constant pressure, or the pressure of a gas at constant volume, is proportional to the absolute temperature. Briefly, the two can be expressed in the simple formula $PV = RT$, where R is a constant. The number − 273° used above must not be taken as quite accurate for all gases; but it is remarkable that it is very nearly the same for all gases, more especially for those which used to be called the permanent gases. This is the law of Charles in its greatest generality.

The following symbolization is useful: $v' = v\ (1 + \alpha t') / (1 + \alpha t)$, in which α = the coefficient of expansion, and is taken ordinarily as $2\frac{1}{3}$ or .003663. Or in terms of absolute temperature—$v : v' :: T : T'$ or $v' = vT'/T$.

When both pressure and temperature change, $v' = pv\ (1 + \alpha t')/p'(1 + \alpha t)$ [1] or $v' = pvT'/p'T$ [2]. For finding the volume at 0° C. and 760 mm., standard conditions, as is frequently required, [1] becomes $v' = pv/760(1 + \alpha t)$ and [2] $v' = 273\ pv/760\ T$ or $.359\ pv/T$.

The following are the values of the coefficients for air ($2\frac{1}{3} = .003663$):—Constant pressure: at 1 atmosphere, .003671; at $3\frac{1}{2}$ atmospheres, .003695. Constant volume: at 1 atmosphere, .003665; at 3 atmospheres, .003690. For

carbon dioxide the differences, as might be expected, are much greater. Thus, for constant pressure the coefficients are: at 1 atmosphere, .003710; at 3½ atmospheres, .003845.

Diffusion and Effusion.—If two different gases which do not react chemically are let into a closed vessel, after a time both will be found to be evenly distributed, however different the densities may have been. The pressure that each gas would have, if it alone occupied the whole space, is called its 'partial pressure.' Thus, if a mixture is made of 25 c.c. of gas A and 75 c.c. of gas B, both at 0° c., and at a pressure of 760 mm. of mercury, and each distributes itself evenly, gas A may be said to have expanded from 25 c.c. to 100 c.c.; whence, by Boyle's Law, its pressure would be $.25 \times 760 = 190$ mm.; and similarly, gas B from 75 c.c. to 100 c.c., its pressure would be $.75 \times 760 = 570$ mm. These relations are stated as follows in Dalton's Law of Partial Pressures: The pressure of a gaseous mixture is equal to the sum of the partial pressures of its components. The statement holds best for moderate pressures. This law must be applied whenever a gas is measured over water, on account of the water vapor necessarily present.

Diffusion also takes place between two gases when they are semi-separated by partitions with minute apertures, such as exist in cracked glasses or in unglazed clay and porcelain—different gases diffusing, as discovered by Graham, at rates that are inversely proportional to the square roots of their densities. As a consequence, differences of pressure result in those cases where a porous partition is employed that offers considerable resistance to the free flow of gases in the ordinary way, one gas passing in one direction more rapidly than the other gas moves in the opposite direction.

Effusion of gases is the process in which a gas escapes through a minute hole under the influence of difference of pressure, and is the phenomenon that brings about the state of equilibrium observed in the experiment described above. Graham's law of effusion states: Rates of effusion are inversely as the square roots of the densities of the gases if the pressure conditions are the same, and are directly as the square root of the pressure differences if they are different.

The phenomenon of effusion has been employed by Bunsen to compare the density of a gas with that of another gas of known density. A burette-shaped vessel contains the gas experimented on, the lower and open end being immersed in mercury in a tall cylinder. The upper end is closed by a stopper, below which is fixed a platinum plate pierced by a very small pin hole (about $\frac{1}{50}$ mm. in diameter). At a time observed the stopper is opened, the gas flows out, and the mercury rises in the burette from below. The time is noted which a float on the mercury takes to travel between two marks. The same observation is made on the standard gas, and the densities are taken as being in the ratio of the square roots of the times.

The same phenomenon has been made use of by Lord Rayleigh and Sir William Ramsay to separate argon from nitrogen The densities are, respectively, 20 and 14; and if the mixture be passed in succession through a number of clay tobacco-pipe stems outside of which a vacuum is maintained, the nitrogen will escape through the pipe walls more rapidly than the argon, and hence the mixture issuing from the end of each successive pipe stem will be increasingly stronger in argon.

Solubility.—Liquids have the power of absorbing and retaining gases, the solubility varying with the temperature and pressure. In general, solubility decreases with increase of temperature; but the variation is different for different gases, and is not proportional. Thus 1 litre of water at 15° c. can retain 846 litres of ammonia gas, but only 1 litre of carbon dioxide. At higher temperatures the numbers would be smaller.

The variation with pressure, at constant temperature, of gases moderately soluble, and at pressures not exceeding a few atmospheres, can be expressed thus, as Henry's Law: The weights of a gas dissolved in a given quantity of a liquid are proportional to the pressures. From this and Boyle's Law it follows that the *volume* of the gas that can be dissolved is the same for all pressures. Thus, if a quantity of water will dissolve 1 g. of oxygen at 760 mm., it will dissolve 2 g. at 1520 mm; but this 2 g. of gas being subjected to *double* the pressure, will occupy *half* the volume—that is, the same volume as the 1 g.

In carbonated or 'sparkling' waters the gas (carbon dioxide) is dissolved at from two to three atmospheres pressure. When the pressure is released, the excess of gas over that soluble at the lower pressure is liberated, producing the effervescence.

Viscosity.—If any flat solid be moved over another, there is a mutual force tending to prevent this motion. There is a similar action in liquids and gases tending to retard the motion of one layer of the liquid or gas relative to that next to it. But whereas this action in solids is explained by friction, in the case of gases it is said to be due to the interchange of molecules between the two layers. (See Viscosity.)

Occlusion and Condensation.—If a piece of palladium be used as the cathode of a water voltameter, it will absorb about 900 times its volume of hydrogen gas and still retain its metallic appearance. Those who would regard hydrogen as a metal would describe this as a kind of alloy of the two metals. The phenomenon is known as *occlusion.*

Almost every solid body possesses the property of condensing gas as an invisible but very tenacious film over its surface. Thus, it is impossible to remove completely, even by the most efficient air pump, the film of air from a vacuum tube. The process is made more effectual, however, if the tube be strongly heated. Even then it has been found necessary to 'wash' out the tube repeatedly with hydrogen if it is required to have the oxygen completely removed. The amount of condensation is greatest, of course, when the substance is in a form of aggregation, in which it presents the maximum of surface. Thus, boxwood charcoal can be made to occlude about 90 times its volume of ammonia gas.

See Gases, Kinetic Theory of; Gas or Vapor Density.

Gases, Liquid. See Liquid Gases.

Gases, Poisonous, are of two types: gases such as carbon monoxide, which are poisonous of themselves, causing death when breathed in an atmosphere containing as little as one per cent.; and asphyxiating gases, as chlorine, bromine, and others.

The employment of poisonous gases for military purposes was known in ancient times, one of the earliest recorded instances of their use being in the Peloponnesian Wars of 431–404 B.C. They had little application in modern warfare prior to the World War. During that period the gases used by both the Central Powers and the Allies were subject to the following classification: tear gas (lachrymators), paralysants, lung injurants, respiratory irritants (sternutators), and gases which produce blisters (vesicants).

The tear gases used were xylyl bromide and ethyl iodoacetate which would irritate the eyes of the soldier and impair his vision. Also the fact that the soldier was compelled to wear a gas mask as a protective measure reduced his efficiency.

The paralysant used was hydrocyanic, or prussic, acid. In concentrated form this gas affected the nervous system in such a manner as to cause instant death. However, the use of this gas was not practical because its relatively light density, slightly less than that of air, made delivery upon

the enemy in concentrated form impossible.

The lung injurants used were chlorine, phosgene, trichlormethylchloroformate, chloropicrin, and diphosgene. The effect of these lung injurants upon the person breathing them, was to cause water to pour into the lungs from the system. Phosgene and diphosgene were responsible for 80 per cent of the deaths caused by gas during the war. Chloropicrin caused vomiting, strangulation, and irritation to the eyes.

Respiratory irritants used were diphenylchlorarsine, diphenylcyanarsine, and ethyl dichlorarsine. The last two named were introduced by the Germans in 1918. These gases caused sneezing and vomiting, which compelled the soldier to remove his gas mask and thus become exposed to the more dangerous gases which were usually released at the same time.

The blister-producers, or vesicants, penetrated the skin and raised blisters which sometimes spread to the rest of the victim's body and incapacitated him for at least a month. For this purpose dichlorethyl sulphide, or mustard gas, was used, and it contaminated everything it touched. Although first introduced in 1917, this gas was responsible for 400,000 of the gas casualties. Lewisite, another vesicant, was in the process of preparation, but the war was ended before it reached the front lines. It contained arsenic, and was intended to poison the blisters it raised.

In the various wars waged between the end of the last World War and the beginning of the Second World War poison gas was not used. Nor was this form of chemical warfare employed by either of the belligerents during the first year of the Second World War. The reason, perhaps, is not a humane one, for military men are of the opinion that gas is no less humane than other lethal weapons used in warfare, but rather that in the earlier stages this was a war of movement instead of one of position.

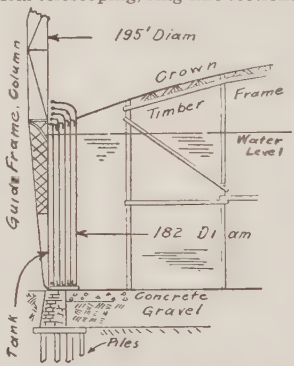
Gas, Fuel. See FUELS.

Gas Furnaces. See FURNACES.

Gas Heating. See HEATING.

Gas Holder, a metallic shell, open at the bottom, like a bell, the lower edge dipping into a deep tank of water which prevents the contained gas from escaping. The framework may be either of steel or timber—the latter being preferred for the largest holders. As the inverted holder shell floats in unstable equilibrium, with the weight of the crown at the highest point, some external guide structure is needed to keep the bottom edge parallel to the water surface in the tank and to resist the overturning force of the wind. This makes necessary three distinct parts to a gas holder—tank, holder shell, and guide frame.

Steel is still the favored material for the tank, which rests on such foundation as the ground makes necessary. For the foundation, wood, brick, masonry, and concrete caps are often placed on piles driven down to firm ground. To avoid the excavation of a large amount of earth, a system of making the gas holder in several telescoping, ring-like sections



Partial Section of Typical Large American Gas Holder.
(A 5,000,000 Cubic Foot Holder in New York City.)

has been adopted. To prevent the escape of gas between the several sections, lutes or channels to contain water are provided; and these form concentric cupped rings which pick up water from the tank as they rise from it, the next larger cylinder having a corresponding grip or inverted cup fitting into the cup that contains the water. In this way, gas holders may have as many as six lifts, holding up to 15,000,000 cubic feet.

The guide frames are latticed steel columns, diagonally braced, and forming a light but strong guide cylinder. The columns are really vertical cantilever beams, arranged circumferentially around the tank, and extending upward to above the top position of the filled holders, to carry guide rails for the rising and falling shell. Guide rails are also carried by the tank inside for the bottom rollers of the outer shell; and on these rails, extended upward and held by the guide framing, are born the tops of the rising shells through rollers on 'goose necks.' The bottom of each shell carries rollers which bear on the inside of the next outer shell, to maintain alignment. A pipe from the generating plant runs under the tank, and up through it to above the water level; another pipe connects with the service mains through the necessary control valves.

The pressure of the gas holder has to be governed and regulated to that suitable for lighting and heating purposes. The governor consists of a small holder, with a cone hanging from its centre, which serves to close more or less completely an aperture in the pipe through which the gas passes. The holder is balanced, and weights are put upon it according to the pressure required on the outlet, and the gas is brought to the under side of the holder from the outlet side of the governor. The weight upon the holder causes it to fall, and lowers the cone with it, thus opening the aperture to allow more gas to pass through until the pressure on the outlet side and under the holder is sufficient to lift it and the weight upon it, when the cone alone arises and closes the aperture. When working, the cone quickly assumes the position which allows the right quantity of gas to pass to keep up the pressure, and changes only as more or less gas is required.

Gas, Illuminating. See GAS MANUFACTURE; GAS LIGHTING.

Gaskell, ELIZABETH CLEGHORN (1810–65) English novelist, was born in Chelsea. Her youth was passed at Knutsford, Cheshire (immortalized in *Cranford*). In 1832 she married William Gaskell (1805–84), a Unitarian minister of Manchester. Here she studied working men and women from the life, and devoted her days and nights to teaching them and relieving their distress. *Mary Barton* (1848), a novel of factory life, made her famous. *Cranford* (in *Household Words*, 1851–3) was a series of exquisite studies of village life. Then followed *Ruth* (1853); *North and South* (1854); *Lizzie Leigh* (1855); *Life of Charlotte Brontë* (1857), which caused much controversy; *My Lady Ludlow* (1859); *Sylvia's Lovers* (1863); *Cousin Phillis* (1865). She had some measure of almost all the gifts of the great novelist —deep and genuine pathos, a singularly genial and truthful humor, a graceful and unforced style, power of description, dramatic faculty on occasion, and sympathetic insight into character. Though written with a purpose, her novels are still artistic creations, perhaps because they flowed so freely from her heart, and were so truly and so much herself. Consult Mrs. Chadwick's *Mrs. Gaskell: Haunts, Homes, and Stories* (1910).

Gas Lighting. The light-giving quality of a gas flame depends upon the liberation of particles of carbon within the flame, and their subjection to heat sufficient to raise them to incandescence. Gases used for lighting, therefore, are either naturally rich in hydrocarbons—as in coal gas—or the hydrocarbons are added artificially—as in water gas. By the chemical action

which takes place in the flame the free hydrogen in the gas unites with the oxygen of the air at high temperature, decomposing the hydrocarbon gas, and setting free the carbon in minute particles which glow in the intense heat. If too much air is admitted, however, the carbon also is oxidized, and the flame becomes non-luminous, as in the Bunsen burner.

The gas commonly distributed by public service companies for lighting, heating, and cooking is either *Coal Gas* or *Water Gas*. (See GAS MANUFACTURE.)

The gas is conveyed from the works by main pipes or 'mains' —those of a diameter of four inches or more being of cast iron, and smaller sizes of wrought iron. The jointing of the cast iron mains is effected by machining so that the pipes fit accurately, and the joints are then made absolutely gas tight with oakum and a ring of melted lead, or 'lead wool.' The cement joint, with two annular layers of caulked oakum and two of cement, is also used. In some cases, as in crossing rivers, the pipes are connected by ball-and-socket joints; in others, special devices are provided to allow for expansion.

The mains are laid on grades of not less than 1 inch in 100 feet, to afford drainage for the water which condenses from the gas. At low points provision is made for taking off the water through a trap, and a 'well' gathers the liquid, whence it is pumped out at intervals.

For detached houses in the country several other kinds of gas have come into use.

Liquid Gas—the liquefied heavy or 'wet' gases of oil wells—is distributed in steel cylinders holding an equivalent of 1,200 cubic feet of gas; and these may be connected to ordinary house piping. This gas does particularly well with mantles; and it has proved the cheapest of all illuminants, measured by candle-power hours.

Blau Gas is a liquefied coal gas into which are dissolved some of the permanent gases.

Pintsch Gas, used principally in the lighting of railway trains, is a mixture of the gases produced by decomposing petroleum.

Acetylene Gas (q.v.), formerly used only for detached lighting plants, is now employed for town lighting as well.

RISKS.—The risks of gas lighting are twofold—explosion and poisoning. Explosion cannot occur until there is from 7 to 8 per cent. of gas in the air; but it is dangerous to 'look for a leak with a light,' as the highest explosive percentage is always near the leak. In the case of poisoning, the gas must escape into a room until there is about one-half of 1 per cent. of carbonic oxide—*i.e.*, from 4 to 12 per cent. of coal gas—in the air of the room, before danger to life becomes imminent; and this percentage is rarely attained by ordinary escapes into rooms of fair size. Fatal accidents are usually caused by escapes into small rooms, or by the passage of gas from broken mains through the earth into the basement of a house, whereby the gas becomes deodorized, and thus escapes notice. A gas escape is more apt to be serious in its consequences when it takes place into the upper part of a room.

Consult Gerhard's *American Practice of Gas Piping and Gas Lighting* (1908); Webber's *Town Gas and Its Uses* (1907); Hole's *Distribution of Gas* (1912).

Gas Mantles. The process of manufacture of the mantles whose incandescence produces the light with Welsbach burners is as follows: (1) knitting a textile form; (2) saturating this form with certain earthy salts; (3) removing the textile form; (4) providing a temporary support for the fragile mantle during transportation.

At first the textile form was knitted of cotton yarn, and the cheaper grades of mantles are still made in this way. It was soon found that the texture imparted to the deposited salts by the cotton yarn was lacking in durability, and that its incandescence diminished rapidly; and as the result of many experiments, ramie fibre was selected.

The yarn is knitted into a long, tubular form, which is thoroughly washed, and then cut into mantle lengths. These are dipped into a bath of which thorium nitrate constitutes about 98 per cent. of the solid ingredients and cerium nitrate about 2 per cent. Most manufacturers claim to add other and secret constituents. After the nitrate bath the mantles are dried, and then subjected to a hot flame which burns away the textile form and changes the partially fused earths into oxides. Next, the mantles, which are now in an exceedingly fragile condition, are dipped into collodion, which gives them the necessary body to permit of handling and transportation. The collodion is burned away when the mantle is first lighted in its place on the burner.

A recent development is the use of artificial (synthetic) silk as the fibre from which the mantle is knitted. It is claimed that these mantles give a radiation equal to the best ramie mantles, and have about six times the latter's durability. See GAS LIGHTING.

Gas Manufacture. The first manufactured gas of record was made by John Baptist van Helmont of Brussels about 1609. He produced it by combustion, fermentation, and the action of acids on limestone. Another early experimenter (1660 to 1670) was Dr. John Clayton, a Yorkshire minister. By heating coal in a closed vessel he found that a 'spirit which issued out caught fire at the flame of a candle.' Jean Pierre Minckelers, after many experiments in 1784, lighted gas distilled from coal as a demonstration to his class in the University of Louvain. Bladders were the usual receptacles used for storing gas by these early delvers into its mysteries.

Late in the eighteenth century William Murdock (q. v.), engineering assistant to James Watt, who invented the steam engine, devoted himself to the task of producing gas from coal in sufficient quantities to permit its use for lighting. By distilling coal in an iron retort and conducting the gas through 70 feet of tinned and copper tubes, he succeeded in lighting his home at Redruth in Cornwall in 1792. In 1798 he moved from Cornwall to the works of Boulton, Watt and Company (makers of steam engines in Soho), where he built machinery on a large scale and lighted the factory with gas. On the occasion of the celebration of the Peace of Amiens (the signing of a treaty between Great Britain, France, Spain, and Holland) in April of 1802, the new light was publicly displayed, attracting wide attention. Murdock built a gas works and lighted the cotton mill of Messrs. Phillips and Lee at Manchester with 900 burners in 1804.

In France, Philippe Lebon was the most active and successful among early students of gas. In September of 1799 he obtained a patent for making gas by distilling coal or wood and in 1801 lighted his home and gardens in Paris. The demonstrations of both Murdock and Lebon were widely praised by the press and thus caught the attention of Frederick Albert Winsor, a German. Winsor, who apparently was a mediocre scientist but a fine promoter, journeyed from Frankfort to Paris where he witnessed 'the wondrous effects of common smoke being made to burn with greater brilliancy and beauty than wax or oil.' In 1804 Winsor ob-

Gas Manufacture

tained the first English patent for gas-making purposes. He had a vision of the future of the gas industry, but was faced with a Herculean task in fighting against established customs, prejudices, and superstitions; also in smashing that sturdy stone wall of stubborn skepticism which ever confronts the innovators. Said Sir Walter Scott, in a letter to a friend, 'There is a madman proposing to light London with—what do you think? Why, with smoke.' Napoleon, too, on hearing of the plan to light London's streets with gas, dismissed the idea as 'une grande folie.' Despite opposition and ridicule, however, Winsor succeeded in obtaining a large number of shareholders in his company, and the first public street-lighting with gas took place in Pall Mall in London in 1807. Winsor sought for his company the exclusive privilege of lighting by gas in all the British possessions, but such a broad charter was refused. In 1812 Parliament granted a charter to his company, 'The London and Westminster Gas Light and Coke Company,' and thus the world's first gas company came into being.

Credit for the first demonstration of gas in the United States (in August of 1796 at Philadelphia) is given in Watson's *Annals of Philadelphia* to M. Ambroise & Company, Italian fireworkers and artists. In 1812 David Melville of Newport, Rhode Island, lighted his home and the street in front with gas which he manufactured. He also lighted a factory at Pawtucket and induced the government to use gas at Beaver Tail Light House.

The introduction of gas lights in Rembrandt Peale's museum in Baltimore in 1816 aroused so much interest that it led to the organization of a gas company and the lighting of the streets of that city with gas. Thus the first gas company in the United States came into existence, and in 1816 Baltimore became the first city in the United States to light its streets with gas. The streets of Paris, France, were first gas-lighted in 1820.

In 1855, Robert Wilhelm von Bunsen invented the blue flame gas burner (See GAS BURNERS) wherewith it was possible to burn gas more economically, with an intensely hot but smokeless flame. In 1885 Karl Auer (q. v.), who had studied under Bunsen at Heidelberg in Germany, invented an incandescent mantle, made of metallic oxides, for use on Bunsen burners. For this achievement he was awarded the title 'Baron von Welsbach.'

Strangely enough it was the replacement of gas-lighting by electric-lighting late in the nineteenth century which started gas production and distribution toward its present status as a major industry. When faced with the necessity of finding other outlets for their product, the gas pioneers embarked upon a program of research which brought to light innumerable uses for gas.

The early history of manufactured gas, as outlined above, is based upon facts supplied by the American Gas Association. Its later history is the history of modern gas appliances. See GAS ENGINES, GAS RANGES, etc. See also NATURAL GAS, for the history of manufactured gas and that of natural gas have been closely linked, both in early and recent times.

Statistics.—Buyers of manufactured gas in the United States on the first day of 1940 numbered 10,115,900, as compared with 9,947,100 at the beginning of 1939. Gas sales to these customers for the year 1939 totaled 368,666,500,000 cubic feet valued at $370,529,300, as compared with 353,631,000,000 cubic feet valued at $362,518,000 in 1938.

Customers in the United States to the number of 9,971,000 bought in 1937 a total of 356,081,800,000 cubic feet of manufactured gas as compared with 7,038,000 customers who bought 1,336,034,000,000 cubic feet of natural gas. For this gas, totaling more than a trillion and a half cubic feet, the public paid $802,346,000. This service required 271,070 miles of transmission and distribution mains. Of this, 91,400 miles was used for manufactured gas while 179,670 miles was used for natural gas, transmission mains for the natural product being in some cases 1,200 miles long. The investment in the gas industry, including the natural-gas companies, exceeds by nearly 20 per cent the amount of capital employed in the production of steel. While approximately $4,200,000,000 has been invested in the steel plants of the United States, almost $5,000,000,000 of capital is required to provide gas service to those using gas in their homes and places of business. The industry in 1937 paid $82,607,000 in taxes.

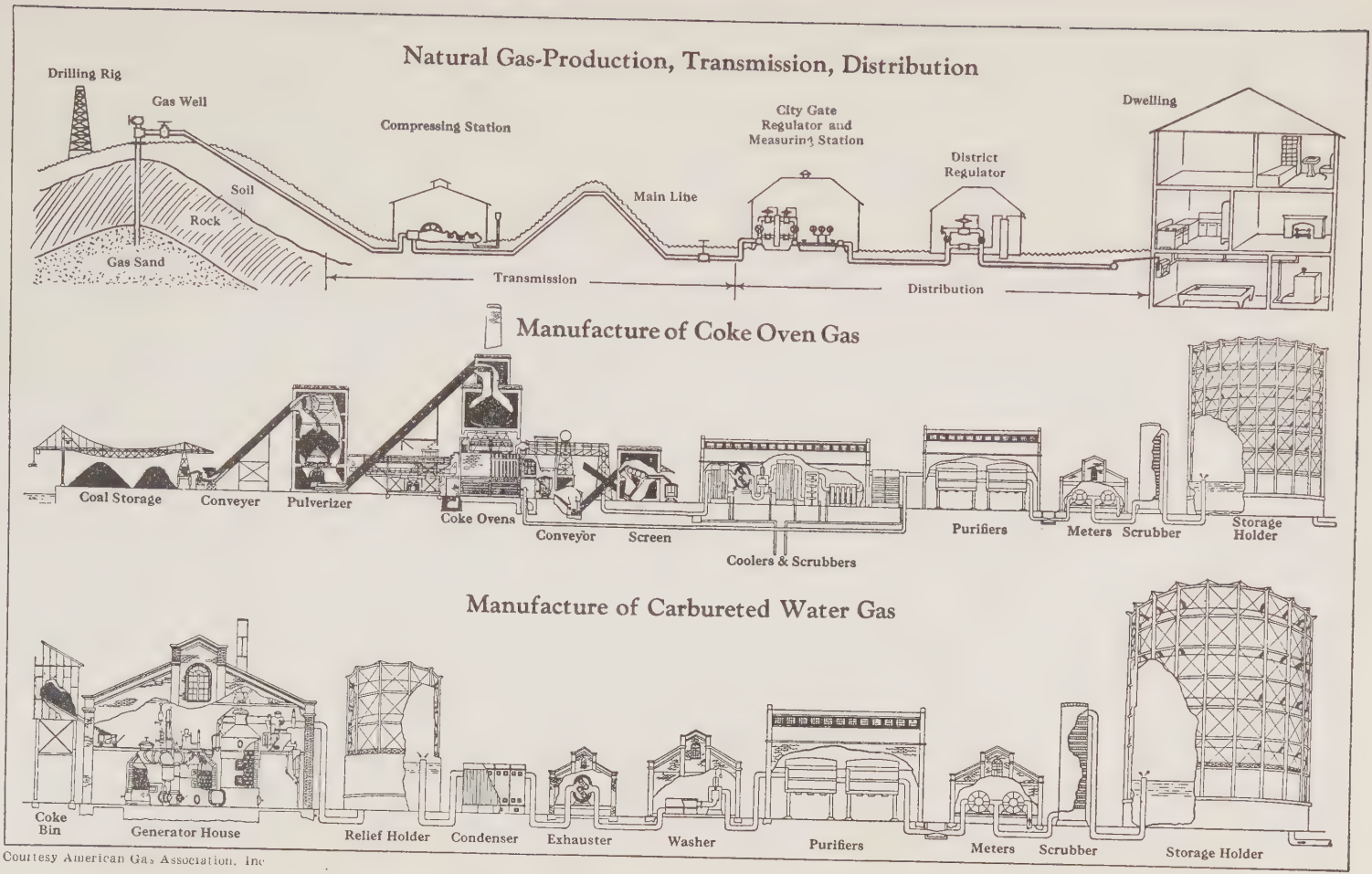
Approximately 1,500 gas companies in the United States supply gas to more than 8,000 cities, towns, and villages, having a total population in excess of 80,000,000—nearly two-thirds of the nation's entire population. To operate these companies and provide the high standard of service maintained by the industry required the employment of 135,400 people in 1937. These employees received $213,189,000 for their work in the industry, or an average of $1,575 each annually. This exceeds the average annual wage of employees in the oil, steel, automobile, telephone, and electric light and power industries, and is exceeded only by the average annual wage of employees in the railroad business.

Domestic or residential customers to the number of 15,998,000 used 605,220,000,000 cubic feet of gas in 1937 for cooking, water heating, refrigeration, house heating, air-conditioning, and other purposes. Industrial and commercial customers numbering 1,002,000 used 1,068,317,000,000 cubic feet. The domestic customers had in use more than 16,000,000 gas ranges and 1,125,000 gas refrigerators. More than 1,300,000 dwellings were heated by gas. The industrial and commercial applications of gas, exceeding 20,000, include almost every process which requires the use of heat.

Coal Gas.—Bituminous coal, which has a high proportion of volatile constituents, is generally used for making coal gas. The coal is fed into large heat-resistant retorts which are kept at bright red heat. The resulting distillation breaks down the coal into coke, ash, and volatile materials from which the gas is later separated by other processes.

Iron, clay, and silica have been used in the construction of retorts, but silica molded into large blocks has been more commonly used in recent years because of its better heat-resisting qualities. The horizontal retorts long used in gas manufacturing have been largely replaced in recent years by vertical retorts into which coal is fed by gravity. The retorts are assembled in groups, usually from three to nine in number, each group being built into a brickwork structure lined with firebrick, known as a 'bench.' This bench contains, below the retorts, a furnace from which burning gases rise through flues surrounding the retorts. In this way the required temperature (usually about 1,400 degrees Fahrenheit) for proper coal distillation is maintained. The producer gas ordinarily used for heating the retorts will be discussed in a later paragraph.

Above the bench or series of benches runs the large collecting main into which open the connecting pipes, called 'standpipes,' from the various retorts. Into this main the volatile matter (crude gas) passes from the retorts. At this stage the residuals and impurities in the gas, expressed in percentages by weight of the crude gas, are: tar, 33 per cent; water vapor, 50 per



Courtesy American Gas Association, Inc

Gas Manufacture

cent; ammonia, 2 per cent; carbon dioxide, 5 per cent; hydrogen sulphide, 2 to 5 per cent; other sulphur compounds, as carbon disulphide and organo-sulphur compounds, 1 to 3 per cent.

The collecting main, commonly called the 'hydraulic' main, is kept about half full of water and tar, and the pipes from the retorts, after passing through the side of this main, bend over and dip into the liquid. Thus the crude gas, in entering the collecting main, must bubble through the liquid, being cooled while condensing, and leaving in the liquid some of the heavier impurities. The remaining gas is then pumped by an 'exhauster' through 'washers,' usually two in number: a Livesey washer in which the gas bubbles through ammoniacal liquor, and a rotary washer. The latter is a horizontal cylinder, also containing ammoniacal liquor, equipped with brushes attached to a horizontal rotating shaft. The whirling brushes bring the washing liquor into close contact with the gas. After being thus freed from ammonia and other impurities, the gas contains ½ per cent of hydrogen sulphide. After leaving the washers the gas usually is warmed in a heating receptacle before entering the purifiers. These purifiers are large boxes containing hydrated oxide of iron spread on grids. After passing over this chemical, the gas, now freed from hydrogen sulphide by the absorbent action of the oxide, contains mere traces of sulphur compounds, such as carbon disulphide. The gas then passes through a meter to the storage 'holder' before being distributed to the street mains.

In some gas works the gas is also washed (after leaving the purifiers) with petroleum or creosote oil to dispel the naphthalene, thereby lessening the risk of blocking distribution mains. In some cases the gas is also washed with strong solutions of calcium chloride or glycerine to rid the gas of water vapor. This prevents later deposition of water in the mains.

The finished coal gas, as sent through mains to consumers' premises, contains carbon dioxide, unsaturated hydrocarbons, oxygen, carbon monoxide, hydrogen, methane, and nitrogen. These in varying proportions depending on the type of retort used (whether horizontal or vertical), the nature of the heat used for distillation (whether of high or low temperature), and a number of other factors.

The quantities of the various products obtained from the destructive distillation of a ton of coal are: gas, 10,000 cubic feet, or 17 per cent; tar, 10 gallons, or 5.1 per cent; virgin ammoniacal liquor, 7.9 per cent; coke, 70 per cent.

Carbureted Water Gas.—Carbureted water gas is the invention of Thaddeus S. C. Lowe, an aeronaut, who died in 1913. Lowe became interested in aerostatics and just before the Civil War made a balloon trip of 700 miles. During the Civil War he was made chief of the aeronautical corps in active operations. He watched from captive balloons and reported by telegraph the movements of the Southern troops. Lowe experimented in gas manufacture in connection with his balloon experiences, and in 1874 built a water-gas plant at Phoenixville, Pennsylvania, for the manufacture of illuminating gas.

The term 'water gas' is a misnomer, but was used by gas engineers in the early days of its development to distinguish it from coal gas, then in general use. Engineers called the new gas 'carbureted water gas' because it was made by passing steam through incandescent hot coke or anthracite and adding oil gas to enrich or carburet the water gas thus produced.

In Lowe's process, carbureted water gas is manufactured in three large cylindrical vessels, standing upright side by side. These vessels are called generator, carburetor, and superheater. Each is lined with firebrick. They are so connected that the gas from the generator may pass continuously through the carburetor and superheater to the purification apparatus. In addition to the firebrick lining, the carburetor and superheater are filled with firebrick, placed crisscross, forming a honeycomb arrangement which breaks up the gas into many small streams in its passage through the three cylinders which comprise a 'set.'

As the first step in this gas-making process, the apparatus is closed and a waste connection to the atmosphere is opened. The generator is filled with a good quality of coke or anthracite, or a mixture of these two, or even some bituminous coal. This is ignited and air is blown through the apparatus until the whole equipment reaches a proper temperature for gas making. The hot gas from the burning fuel in the generator passes into the honeycombs of the carburetor and superheater and, after being mixed with air, burns through the honeycombs, heating the bricks of these chambers to a dull cherry color. The burned gases pass through the waste connection to the atmosphere.

When the proper initial heat is reached, the gas manufacturing cycle begins. This cycle consists of alternate periods of gas making and reheating. For gas making, the waste connection is closed, the connection to the purification equipment is opened, the air blast is shut off, and steam is turned into the generator. The steam, while passing through the red hot fuel into the generator, reduces its temperature and, after about four minutes of gas making, the fire is cooled to such a point that the reaction no longer takes place. The steam is then turned off and the air is again passed through the fire until the whole apparatus is brought up to the initial temperature and the cycle repeated. As the steam passes through the hot fuel, it reacts chemically, producing two gases, carbon monoxide and hydrogen. These pass into the top of the carburetor. The mixture of these two gases is known as "blue" water gas.

Because this gas mixture has a low heating value, it is necessarily enriched by mixing with it a gas of high heatng value derived from gasified oil. This is accomplished by spraying oil into the top of the carburetor. As this oil passes through the honeycomb of hot bricks in the carburetor, it is broken up into gases which have a high heating value. This oil gas mixes with the blue water gas, and by contact with the highly heated surfaces in the superheater is finally 'fixed' into a permanent gas. The gas is now ready to be purified.

From the superheater, the hot crude carbureted water gas passes through water in a washbox. Here the residue of the oil used for enriching remains in the form of a tar. From the washbox, the gas passes into the 'relief' holder which is simply a gas holder of small capacity interposed at this point to equalize the flow of gas from the intermittent manufacturing cycle through the purification equipment.

From the relief holder, an exhauster, similar to that used in the manufacture of coal gas, draws the gas through the cooling and scrubbing apparatus which removes most of the tar and water vapors, and then forces it through the remaining equipment into the storage holder.

The chemical constituents of carbureted water gas are the same as those of coal gas: carbon dioxide, unsaturated hydrocarbons, oxygen, carbon monoxide, hydrogen, methane, and nitrogen. Prior to being carbureted, however, the water gas is simply hydrogen and carbon monoxide produced by the reaction: $C + H_2O = H_2 + CO$.

Oil Gas.—The process of oil-gas manufacture differs little from the procedure in a carbureted-

water-gas plant. To change a carbureted-water-gas plant into an oil-gas plant, an oil-gas set would be added in the generator house, some of the auxiliaries would be slightly modified, and tanks for oil would be required, of course, instead of fuel bins. An oil-gas set is simply a chamber, heated either from within (as in a water-gas set) or from without, into which the oil is sprayed in order that it may be gasified by contact with the heated surfaces.

This completes a brief description of the usual processes of manufacturing gas for utility distribution. The different gases, together with natural gas, are frequently mixed in various combinations. The combination used in an individual instance is determined by local conditions.

Producer Gas.—The decomposition of water or steam in contact with incandescent carbon results in the creation of producer gas, which is widely used in the heating of retorts. The first chemical reaction obtained is the formation of carbonic acid and the liberation of hydrogen; then carbon monoxide (a nonluminous gas, but one having high calorific power) is formed. A plant for manufacturing the gas comprises a producer (or furnace), a vaporizer (absorbing the waste heat of the gas to make the steam needed), a cooling washer, and a purifier (to remove the tar). Sometimes there is a gas holder for storage.

The chief process involved in the preparation of this gas is the passage of a jet of steam and air through a generator containing coal or tar.

In the mechanical means adopted for arriving at this result there are many differences, but in general there are two distinct types of plant: (1) a pressure plant, in which the air and steam are forced into the producer by means of a blowing engine, a fan, some other form of blower, or a steam jet; (2) a suction plant, in which the air is sucked through the producer by the suction of the piston of the gas engine while on its outward stroke. In suction systems no gas holder is needed.

The analysis of producer gases varies greatly, a typical one showing by volume: hydrogen, 1.8 per cent; carbon monoxide, 24.5 per cent; carbon dioxide, 3.7 per cent; methane, 6.8 per cent; oxygen, 0.4 per cent; nitrogen, 46.8 per cent.

Anthracite producers have met with better commercial success, in the hands of ordinary operators, than bituminous producers. It is apparent that with bituminous coal fired in an ordinary producer there is a tendency for the fuel bed to cake together, thereby impeding the draft and leading to uneven combustion. The vapors distilled from fresh-fired bituminous coal are not fixed, and they condense as tar, clogging the coolers and washers. Therefore special designs have to be utilized for bituminous sets, in which the aim is to send the unfixed vapors through the incandescent fuel bed, breaking them into gases and solid carbon.

For the manufacture of acetylene gas, see ACETYLENE. See also FUELS; NATURAL GAS.

Bibliography. — Consult O'Connor's *Gas Manufacture and Lighting;* Humphreys' *Construction and Maintenance of Small Gas Works.*

Black Star Photo by Goro

GAS IS MANUFACTURED IN COKE OVENS

Gas Mask, or respirator, a device worn as a protection against the effects of noxious fumes. The first respirators of historical record used in war were those adopted by the Allies shortly after the first effective use of gas (chlorine discharged from cylinders) by the Germans on a four-mile front at Langemarck on April 22, 1915. This early pattern consisted of cotton waste tied over the mouth after being soaked in sodium thiosulphate or sodium carbonate. Respirators wherein the inspired air was filtered through activated charcoal were later used by all combatants in the World War. The German respirator of that period comprised a container attached to an airtight facepiece held around the face by an elastic headband. The container on the British mask was carried in a haversack and connected by a rubber tube with the facepiece, on which a nose clip was fastened to prevent nose breathing. In the French respirator the container was attached directly to the facepiece and clear vision was insured by an arrangement which sent the inspired air across the glass eyepieces to prevent the deposit of moisture. The American army first adopted the British type of mask but later developed a mask without a mouth-

piece or nose clip in which the best features of the British Box Respirator and the French Tissot Mask were combined. In the modern military mask of the United States the air is filtered by a highly activated form of cocoanut shell charcoal, neutralized in the canister by contact with granules of permanganate and soda lime, and passed through corrugated hose to the facepiece and across the eyepieces, which are thus kept clear for vision. Made of moulded rubber covered with protective stockinet, the facepiece is adjustable to fit all types of faces. During The Second World War gas masks were routinely carried by all soldiers and a large percentage of civilians of the principal warring nations. Illustrative of the thoroughness with which England prepared against gas were the 1,400,000 babies' gas masks designed to allow thumb-sucking which the British government ordered in August of 1939, and the myriads of gas mask carriers which in warring England were cleverly fashioned by dress designers to harmonize with street apparel. Respirators have peacetime uses connected with mining, influenza, hay fever, etc.

Acme Photo

SOLDIER EQUIPPED WITH GAS MASK

Gas Meter. The first meter for measuring gas was invented in 1815 by Samuel Clegg, an Englishman, and the basic principle of that first meter (the turning of a cylinder by gas pressure) was retained in all gas-measuring devices thereafter. The modern gas meter is simply a device for measuring the volume, or cubic feet, of gas used. In the United States the type of meter most often employed is a tight metal box permanently divided through the center into two separate chambers in each of which is a movable partition which divides it into two parts of variable size, making four chambers in all.

The operation of measuring gas consists in alternately filling and emptying these four chambers, and accurately counting the number of times each one is filled and emptied. The volume of each chamber is accurately known so that by counting the number of times the various chambers are filled and emptied, there is an accurate measurement of the volume of gas which has gone through the meter. In practice, the alternate filling and emptying of these chambers is so arranged that while one is being filled, another is being emptied, thus giving a continuous flow of gas to the consumer's equipment, instead of the intermittent puffs which would result from the use of one chamber or if all were filled or emptied simultaneously.

On top of this tight metal box is another box which contains the mechanism for counting the fillings and emptyings of the various chambers, and for registering this count directly in cubic feet on a set of dials.

A form of mechanism invented by Prof. C. C. Thomas of the University of Wisconsin has been widely used in station meters. In this type of meter a transverse grid of electric heating wires is inserted in the gas main to raise the temperature by a stated amount as the gas passes. Thermostats control the amount of current needed, and a watt meter records the energy input. By knowing the specific heat of the gas supplied in the main, the energy supply gives at once the total quantity passed in a given time, and the watt meter may be read directly in cubic feet. This device is both compact and accurate. Variations in the composition of the metered gas cause variations in the specific heat within one per cent for all ranges of coal, water, and oil gas. The average specific heat for 100-per-cent coal gas is 0.02114; and for 100-per-cent water gas, 0.02094.

Gas, Natural. See NATURAL GAS.

Gasoline, Gasolene. See PETROLEUM.

Gasoline Engines. See OIL AND GASOLINE ENGINES.

Gasometer. See GAS HOLDERS.

Gas or Vapor Density is the specific gravity or relative density of a substance when in the state of gas, the standard of comparison being air or hydrogen, measured under the same conditions of temperature and pressure. Hydrogen is most commonly taken as a standard, as its use permits certain theoretical deductions, pointed out below, to be more easily made than it the comparison is with air.

The methods of determination vary in detail according to the temperature at which the substance in question becomes a gas, but are in principle the same in almost all cases, a given volume of the gas being weighed, or a given weight measured, under known conditions of temperature and pressure. For the sake of uniformity in the calculation, it is assumed that the gas would obey Boyle's and Charles' Laws (see GASES, LAWS OF), if brought to standard temperature and pressure (0° c. and 760 mm.); and the weight of a litre is calculated under these conditions,

and compared with the weight of a litre of air (1.293 grams) or of hydrogen (.08985 gram). Thus, if 1,420 c.c. of oxygen at 12° c. and 762 mm. weigh 1.9434 grams, the volume at 0° and 760 mm. would be $1{,}420 \times \frac{273}{285} \times \frac{762}{760} = 1{,}360$ c.c., the weight of a litre $\frac{1.9434}{1360} \times 1000 = 1.429$ grams, and the gas density $= \frac{1.429}{.08985} = 15.88$.

If the substance of which the density is to be measured is a gas at ordinary temperatures, Regnault's method, as improved by Rayleigh and others, is employed. An outline of the process is as follows: A large spherical glass flask, of which the capacity is known, is exhausted and counterpoised by a similar flask. The pure gas in question is then allowed to flow in till a definite pressure is reached, being the while immersed in a bath of known temperature, preferably of melting ice. The gain in weight represents the gas added, and from the capacity of the flask, the temperature, and the increase of pressure due to the gas, the density is calculated as above.

If the substance is a solid or liquid at ordinary temperature, the operation is carried out at a temperature sufficiently high to insure that the substance is completely volatilized. One of the oldest ways of accomplishing this is that invented by Dumas, in which a flask with a fine neck (Fig. 1) is first weighed full of air,

FIG. 1.—*Dumas Bulb.*

and from the capacity of the flask the temperature, pressure, and weight of a litre of air, the weight of air in the flask is calculated. Some of the substance—in quantity several times that sufficient, when in the state of gas, to fill the flask—is put into the flask, which is then immersed in a bath of suitable temperature—*e.g.*, of boiling water, mercury, or sulphur, molten fusible metal, lead, etc. Only the neck protrudes, and is sealed by the blowpipe as soon as the excess of substance has evaporated off, driving the air before it. The weight of the flask and substance, less the weight of the flask without air, gives the weight of the substance filling the flask at the atmospheric pressure and the temperature of the hot bath,

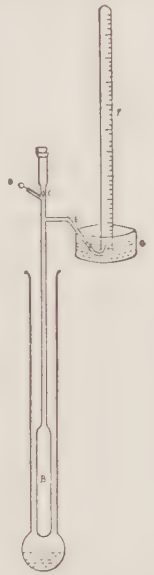


FIG. 2.—*Victor Meyer Vapor Density Apparatus.*

A, Outer vessel to maintain constant temperature in B, inner vessel; C, small flask, containing weighed liquid to be vaporized, released by wire D; E, delivery tube; F, eudiometer, in which displaced air, equal in volume to the vapor formed, is measured; G, pneumatic trough.

from which the density can be calculated as before.

Another very valuable method is that of Victor Meyer, in which the weighed substance is dropped into a long-necked flask (Fig. 2), the bulb of which is immersed in a bath heated well above the boiling point of the substance. The bulb is filled with air, or inert gas, and is provided with a delivery tube, so that the air or gas pushed out by the volatilization of the substance at the bottom of the bulb can be collected in a measuring tube over water or mercury. It thus follows that the volume of this gas represents the volume which the volatilized substance would occupy if it could be brought to the temperature and pressure of the measuring tube without condensation; and hence the gas density can be calculated.

If the temperature required to volatilize the substance is so high that there is risk of decomposing it, the above methods may be modified so as to work under reduced pressure; but the plan more commonly employed in such a case is that invented by Hofmann, in which the weighed substance is vaporized in the vacuum of a heated barometer, the volume under the reduced pressure being measured.

Methods not depending on the weighing of a given volume include the effusion method of Bunsen and the hydrostatic method of Schloesing. In the former the rate at which the gases to be compared escape through a minute hole is measured, when their densities are calculated, as they are proportional to the square of the times of escape of equal volumes; and in the latter a column of the gas is balanced against a column of another gas, such as carbon dioxide, when their densities will be inversely as the heights of the columns.

Application of vapor density constants in certain theoretical considerations may be illustrated as follows: According to Avogadro's hypothesis, equal volumes of gases, under the same conditions of temperature and pressure, contain equal numbers of molecules; so the ratio between the weights of equal volumes would express also the relative weights of the molecules. Now, if the standard of comparison is hydrogen, the gas density of a substance would show how many times its molecule is heavier than the molecule of hydrogen; and if the molecule of hydrogen consists of two atoms, then twice the gas density of a substance is equal to the number of times the molecule of it is heavier than the atom of hydrogen. By virtue of this relation we are enabled to choose which multiple of the simple formula of a substance, as found from analysis, should be taken to represent the formula of the molecule, or to decide whether the molecule may be supposed to have undergone any process of decomposition or dissociation. See DISSOCIATION; MOLECULE.

Consult Ostwald's *Physico-Chemical Measurements* (Eng. trans.); Travers' *Study of Gases*.

Gasparin, AGENOR, COMTE DE (1810–71), French legislator, was born in Orange. He held a position in the ministry of the Interior and the Ministry of Agriculture and Commerce. Elected deputy for Bastia, Corsica, in 1842, he became a vigorous opponent of slavery and every form of religious intolerance, especially as shown toward his Protestant co-religionists. In 1846 he discarded politics for the pen. He upheld the cause of the North in the American Civil War, and expressed his views in *Les Etats-Unis en 1861* (1861), and *L'Amé-*

rique devant l'Europe (1862), which were translated and widely read in the United States. Consult Borel's *Life* (Eng. trans.).

Gasparin, VALERIE BOISSIER, COMTESSE DE (1813–94), French authoress, wife of A. Gasparin (q. v.), was born in Geneva. She shared her husband's enthusiasm for religious freedom and the Reformed religion. Her book, *Le Mariage au Point de Vue Chrétien* (1843), received the Montyon Prize of the French Academy. It appeared in abbreviated English adaptation as *The Four Homes* (1861). She also wrote a popular criticism of the Salvation Army, entitled *Lisez et Jugez* (Eng. trans.), and *Les Horizons prochains et les Horizons célestes* (Eng. trans.). Consult Dutoit's *Life*, in French.

Gaspé, a peninsula in the eastern part of Quebec province, Canada, comprising the counties of Gaspé and Bonaventure. It projects into the Gulf of St. Lawrence, between the estuary of that name on the north and the Bay of Chaleurs on the south. It has an area of nearly 8,000 square miles, and about 55,000 inhabitants, the greater number engaged in the fisheries, which, with the export of lumber, form the staple business of the country.

Gaspé, PHILIP IGNATIUS (1714–87), Canadian author, was born in Quebec. He entered the army in 1827, served in the campaign against the Foxes (1735), and was with Baron de Longueil in his expedition against the Natchez and Chicachas on the banks of the Mississippi (1739). He built a fort (1750) on the River St. John, which he commanded for some years; was present at the attack on Fort Necessity; and commanded the Canadian militia at the defence of Fort Carillon. In 1761 he received the cross of St. Louis, and retired to private life.

Gaspé Basin, a port of entry and summer resort in Gaspé Peninsula, Canada. It is the seat of extensive fisheries. Here Jacques Cartier first landed in Canada (July 24, 1534). Pop. 500.

Gas Poisoning. See GAS LIGHTING, *Risks*.

Gasquet, FRANCIS AIDAN (1846–1929), abbot of the English Benedictines, was born in London. He was superior of the Benedictine college and monastery at Downside, Somersetshire. He occupied a distinguished place as a Roman Catholic historian, and has written: *Henry VIII. and the English Monasteries* (1888–9); *Edward VI. and the Book of Common Prayer* (1890); *The Last Abbot of Glastonbury* (1895); *A Sketch of Monastic Constitutional History* (1896); *The Eve of the Reformation* (1900); *English Monastic Life* (1904); *Life of Pope Gregory the Great* (1904); *Henry III. and the Church* (1905); *Parish Life in Mediæval England* (1906); *The Greater Abbeys of England* (1908).

Gas Ranges and GAS STOVES are contrivances that utilize the heat of gas for cooking and other purposes. The gas is burned with an admixture of air so as to form a hot, non-luminous flame. The burners are simple—usually in the form of pipes perforated with rows of holes, drilled evenly along the top; and the volume of air is graduated by means of adjustable shutters at the ends of the pipes. The top of the ordinary household range is provided with several burners of different capacity; and underneath is an oven, also heated by pipe burners. The products of combustion should be carried into a chimney by means of a flue pipe.

Gassendi (properly GASSEND), PIERRE (1592–1655), French philosopher, was a native of Provence. In 1612 he settled at Digne as lecturer in theology. Shortly after 1617 he became professor of philosophy at Aix, where he wrote the first part of his *Exercitationes Paradoxicæ adversus Aristoteleos*, a revolt against the Aristotelian philosophy. After 1628 he spent several years travelling through Holland, Flanders, and France, until in 1645 he was appointed to the professorship of mathematics at the Collège Royal de Paris, where he died.

Gassendi was a philosophical critic rather than an original thinker. In 1642 he criticised adversely the new system of philosophy promulgated by Descartes, in a work entitled *Objectiones ad Meditationes Cartesii*. While at Paris he wrote his principal philosophical works, *De Vita Epicuri* (1647); a commentary on Diogenes Laertius' tenth book, *De Vita, Moribus, et Placitis Epicuri* (1649); and in the same year the *Syntagma Philosophiæ Epicureæ*, which contains a complete view of the system of Epicurus. But while thus going back to the ancients in his philosophy, Gassendi marched in the van of the moderns in natural and physical science. Kepler and Galileo were numbered among his friends. His *Institutio Astronomica* (1647) is a clear and connected representation of the state of the science in his own day; in his *Tychonis Brahæi, Nicolai Copernici, Georgii Puerbachii, et Joannis Regiomontani Vitæ* (Paris, 1654) he gives an account of the lives of these men, and a history of astronomy down to his own time. To physical science he rendered good service by his insistence on the value of observation and experiment. Consult Thomas' *La Philosophie de Gassendi*; A. Martin's *Histoire de la Vie et les Ecrits de P. Gassendi*.

Gassner, JOHANN JOSEPH (1727–79), Austrian exorcist, was born near Pludenz, in the Tyrol. He pretended to heal the sick by exorcism, until his imposture was discovered, and his practices checked, by Joseph II. (1777), who compelled him to leave Ratisbon, which had become the centre of his activity.

Gas Tar. See COAL TAR.

Gastein, an Alpine valley in the south of the Austrian duchy of Salzburg, 28 miles long, with a number of small villages. The chief of these, Wildbad-Gastein, is a famous watering place, and was a favorite resort of Emperor William I. of Germany. Some 5,000 guests visit the place every summer to drink the waters of its seven warm springs. Pop. of the valley, about 4,000.

Gasteria, a genus of small, evergreen, succulent plants belonging to the order Liliaceæ. They are natives of the Cape, but may be grown under glass in temperate climates, flowering in winter. They have long, thick, fleshy leaves, and bear their flowers in panicles or racemes.

Gasteropoda, or GASTROPODA (Greek 'belly-footed'), a large class of molluscs, to which different limits have been assigned. Among typical Gasteropods are snails, slugs, whelks, cowries, limpets, periwinkles, and the like.

Along with the Cephalopods and Pteropods, the Gasteropods are usually contrasted with the Lamellibranchs by the more or less prominent development of the head region, and by the presence of a rasping ribbon or tongue on the floor of the mouth. In addition, they are characterized by the nature of the 'foot' or muscular ventral surface. Except in certain forms adapted for free swimming, the 'foot' is simple, median, and sole-like. It is the surface on which the animal crawls. The wealth of modification included in the class is so great that no other general characters can be given.

By some, the class of Gasteropods has been restricted to those forms having a distinct head, abdominal foot, and spiral, subspiral, or conical shell or

naked body—thus excluding the *Scaphophoda*. By others it has been further limited to those forms having a spiral or sub-spiral shell or naked body and an asymmetrical arrangement of the internal organs—*Chitonidæ* and related types being thereby excluded. The more common method, however, is to consider the Chiton and allied forms—Amphineura—as an important sub-class, introductory to the Gasteropods. (See CHITON.)

Gasteropods are grouped first of all according to the state of the loop formed by the visceral nerves. In one series the visceral nerve loop is implicated and twisted in the torsion of the asymmetrical body, and furthermore the sexes are separate. These are known as Streptoneura ('loop-nerved'), and include limpets (Patella), ear shells (Haliotis), pond snails (Paludina), cowries (Cypræa), cone shells (Conus), buckies (Buccinum), and the free-swimming Heteropods. This division includes what are often called Prosobranchs, and the numerous genera are further arranged according to the characters of the gills, kidneys, and foot.

In another series the visceral loop is not twisted, and is often very short; the shell is light, and often lost in the adult; and the animals are hermaphrodite. They are known as Euthyneura ('straight-nerved'), and include two sets—Opisthobranchs and Pulmonates. Among Opisthobranchs some retain the usual mantle fold and have a delicate shell—*e.g.*, Bulla and Aplysia; while others (known as Nudibranchs) have their mantle atrophied and no shell—*e.g.*, Doris and Eolis. Lastly, there are the Pulmonates, where gills are replaced by an air-breathing mantle cavity, as in snails (*e.g.*, Helix), slugs (*e.g.*, Arion), and water snails (*e.g.*, Lymnæus).

The eggs of the gasteropods are usually small, and are surrounded with albumen, the surface of which becomes firm, while in the common snail (Helix) and some others there is an eggshell of lime. The eggs not infrequently develop into embryos within the parent; but in most cases they are laid, either singly or in masses, and often within cocoons.

If we accept the broader classification, the number of terrestrial Gasteropods, breathing the air directly by means of a pulmonary chamber, have been estimated at more than 6,000 species; while those living in water have been estimated at more than 10,000 species, mostly marine. Of these, some 9,000 or so belong to the Prosobranchs or Streptoneura, a relatively small minority being Opisthobranchs and Nudibranchs.

The Heteropods and some Opisthobranchs enjoy a free-swimming, pelagic life, but most marine forms frequent the coasts either on the shores or along the bottom. Deep-sea Gasteropods are comparatively few. The locomotion effected by the contractions of the muscular 'foot' is in almost all cases very leisurely, and the average tendency is toward sluggishness.

In the matter of diet, the greatest variety obtains. Most Prosobranchs with a respiratory siphon and a corresponding notch in the shell are carnivorous, and so are the active Heteropods; most of the rest are vegetarian in diet. Numerous genera, both marine and terrestrial, are indiscriminate in their feeding; others are as markedly specialists, keeping almost exclusively to some one form of vegetable or animal diet.

Some marine snails partial to Echinoderms have got over the digestive difficulty presented by the calcareous character of the skins of their victims by a secretion of free sulphuric acid from the mouth. This acid changes the carbonate of lime into sulphate, which is brittle and readily pulverized by the rasping tongue. A few are parasitic—*e.g.*, Eulima, Stylifer, and the degenerate *Entoconcha mirabilis*, all occurring in or on Holothurians.

As voracious animals, furnished with powerful rasping organs, many Gasteropods play an important part in the struggle for existence among marine organisms, while other terrestrial forms are most destructive devastators of vegetable and flowering plants. The manner in which numerous plants are saved from the ravages of snails by their chemical and physical characters is an interesting subject of investigation.

From earliest times, various Gasteropods, such as whelks, have been utilized for human consumption, and also as bait; while the shells, often so beautiful in form and color, have been used for the decoration of the person and the dwelling, for the basis of cameos, as domestic utensils, or even as weapons, and in many other ways. From the mucous glands of the roof of the gill cavity in the genera Purpura and Murex exudes the secretion, at first colorless, but afterward becoming purple or violet, which furnished the Tyrian dye of ancient times.

A few Gasteropods occur in strata as far back as the Cambrian, from which remote period they have continued with a steady increase. Almost all the Palæozoic genera are now extinct, and during these ages the siphon-possessing forms seem to have been almost, if not altogether, unrepresented. A host of new Gasteropods appeared in the Jurassic period, and many of the modern families have their origin in Cretaceous times. Numerous as the fossil forms are, the number of types wholly extinct is comparatively small.

See MOLLUSCA; LIMPETS; HETEROPODA; SNAIL; WHELK; PERIWINKLE.

Gaston, EDWARD PAGE (1868), was born in Henry, Ill. He has taken part in the excavations at the prehistoric ruins and cliff dwellings of Arizona and New Mexico; was a member of the Hemenway Archæological Expedition (1888); and has ascended Mount Popocatepetl, Mexico. He has also served in American and Mexican diplomatic missions abroad. He is at present managing editor of the British edition of *The Homiletic Review*, editor of the British edition of *The Encyclopædia of Social Reform*, and European manager for the publishing firm of Funk & Wagnalls.

Gaston, WILLIAM (1778-1844), American lawyer, was born in Newbern, N. C. He was admitted to the bar there (1798). Attaining distinction, he rose to be a member of Congress (1813-17), where he made a strong impression by his eloquence and reasoning power. He held the post of judge of the Supreme Court of North Carolina (1834-44), and was responsible for many of the best laws of that State. The convention to amend the State constitution, held in 1835, acted very largely on his suggestions.

Gaston de Foix. See FOIX FAMILY.

Gastonia, town, Gaston county, North Carolina, on the Southern and the Carolina and Northwestern Railroads; 20 miles west of Charlotte. The town has cotton mills, foundries, and iron works. King's and Crowder's Mountains lie a few miles to the west. Pop. (1940) 21,311.

Gastræa. See GASTRULA.

Gastralgia, Gastrodynia. See DYSPEPSIA.

Gastrectomy is an operation for the partial or complete removal of the stomach. It is

only of recent years that it has been attempted. The sole condition that should justify even the consideration of such a serious operation is cancer of the stomach; and those cases alone are suitable in which the disease is at an early stage, and the patient's strength is still unreduced. Practically, the jejunum must be united with the œsophageal extremity of the stomach. The operation was performed successfully for the first time by Schlatter.

Gastric Catarrh, GASTRITIS, or inflammation of the stomach, may be acute or chronic, and may depend upon constitutional causes such as gout, or upon local irritation by the ingestion of unsuitable food or spirituous liquors. The condition is associated with congestion of the vessels of the mucous membrane and with increased secretion of mucus. The leading symptoms are pain and vomiting, which are exaggerated by the introduction of food.

TREATMENT consists in washing out the stomach, and then giving it the utmost possible rest. Only small quantities of simple food, such as iced milk, should be administered, with bismuth and other sedatives. Counter-irritation may also be employed over the region of the stomach, and constitutional causes must be combated. Thirst may be allayed without provoking vomiting by using enemata of normal salt solution.

Gastric Colic. Colic originally signified pain arising from intestinal spasm; but the term is no longer restricted to bowel affections, and renal, hepatic, and gastric colics are recognized. Spasm of the stomach is frequent in atonic dyspepsia, and the pain usually results from the organ becoming over-distended with gas, which it has been unable to expel on account of spasmodic contraction of the cardiac orifice.

TREATMENT.—Great relief is generally obtained from a mixture containing a little essential oil, such as peppermint or cinnamon, in chloroform water, or from Hoffman's anodyne. In more obstinate cases, hot fomentations prove of service. See COLIC.

Gastric Fever. See TYPHOID FEVER.

Gastric Juice is the secretion from the cells in the mucous membrane of the stomach, and is acid in reaction. It also contains the ferment pepsin, and two other ferments—rennin, and a lactic acid ferment. It is stimulated by pleasant sensations and retarded or stopped by unpleasant sensations. The entrance of food and alkaline saliva into the stomach excites a free flow of gastric juice, although some articles of diet—notably tea, coffee, vinegar, and alcoholic beverages—check the secretion. Of drugs, some diminish, others increase the flow. Its chief action is upon the albuminates or proteids. These are insoluble, but are changed into soluble peptones by the ferment pepsin. Gastric juice has no digestive action upon starch, and it checks the salivary digestion. See DIGESTION; DIET; STOMACH.

Gastric Ulcer. See STOMACH, *Diseases*.

Gastritis. See GASTRIC CATARRH.

Gastrochæna, a genus of boring bivalves (Gastrochænidæ), which also includes the remarkable Aspergillum and Clavagella. The original shell has the two valves typical of Lamellibranchs; but these are delicate, and become surrounded by a secondary tubular shell lining the cavity which the mollusc bores into limestone, coral, and other shells.

G. modiolina, a rare British mollusc, common in the Mediterranean, makes holes about 2 inches deep and ½ inch in diameter. It sometimes bores right through an oyster into the ground below, and makes for itself, plus little stones and particles of *débris*, a flask-shaped case, with its neck fixed in the oyster shell.

Gastrocnemius Muscle. See MUSCLES.

Gastro-Enteritis. See ENTERITIS.

Gastrolobium, a genus of Western Australian evergreen shrubs, belonging to the order Leguminosæ. They require hothouse temperature, but their racemes of yellow flowers and coriaceous evergreen leaves make some of the species worthy of cultivation as ornamental plants.

Gastropoda. See GASTEROPODA.

Gastrostomy (Greek *gastēr*, 'the belly or stomach'; *stoma*, 'mouth'), an operation performed for the relief of stricture of the gullet, to save the patient from the imminent risk of starvation by introducing food directly into the stomach through an external opening.

Gastrotomy (Greek *gastēr*, and *tomē*, 'an incision'), an incision into the cavity of the stomach, generally for the purpose of removing some diseased tissue or foreign body. It is also performed as an exploratory operation to ascertain exactly the nature or extent of disease.

Gastrula, GASTRÆA, the name applied by Haeckel to a thimble-shaped larva which appears in the life history of many different kinds of organisms. Such a larva, as it occurs in an annelid, or in the simple vertebrate amphioxus, consists of an outer layer of cells, or ectoderm, and an inner or endoderm. The inner layer lines the gastral cavity, which communicates with the interior by an opening called the blastopore. The gastrula itself arises from a blastosphere, or hollow ball of cells, by the folding in of the cells at one point, as a thimble might be made by pushing in one side of a hollow ball. The outer and the inner layer of cells of the gastrula always give rise to definite organs of the future animal. Haeckel believes that all many-celled organisms have arisen from a gastrula-like ancestor. See EMBRYOLOGY.

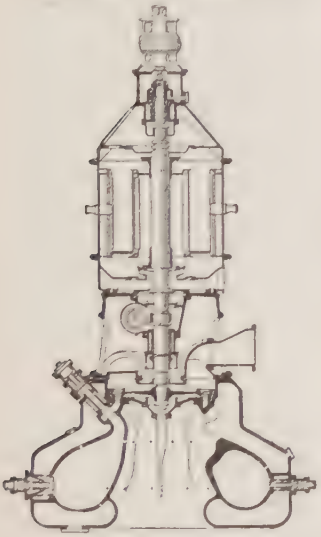
Gas Turbine, a turbine engine operating by the energy of exploded gases. In the first engine of this type, invented in 1906 by René Armengaud in France, the gas and air were compressed separately and the mixture admitted in a steady stream into a combustion chamber where it was ignited by an incandescent platinum wire, forming a continuous flame. The wheel was of the De Laval type.

The most successful of gas turbines is the Holzwarth machine, invented in Germany. Its combustion chamber is intermittently filled with a mixture of gas and air. Then follow ignition, explosion, and increase in pressure of the burnt gases and their expansion through a nozzle, after which they act on a horizontal turbine wheel. The explosion chamber is next effectively scavenged and cooled by fresh air. Five or ten similar explosion chambers are arranged in a circle at the base of the turbine, and act one after the other, or in series. After the combustion chamber has been filled with compressed air, compressed gas is driven in while the nozzle valve remains closed; but immediately upon ignition the valve is forced open by the pressure of the explosion, and the available energy (pressure) in the gases is transformed into kinetic energy (motion) by permitting expansion at the nozzle.

The sectional drawing shows the internal arrangement of a Holzwarth turbine, and the method of mounting the dynamo on a vertical shaft above it. The turbine is provided with a horizontal governor shaft driven by a screw

gearing. On the shaft are keyed the main governor, an emergency governor for preventing ignition, a tacheometer, the gear for operating a vertical oil distributor, and the ignition mechanism.

In Germany the Holzwarth tur-



Holzwarth Turbine, with Superimposed Dynamo.

bine has continued in use to a very limited extent, as has an improved form of the Armengaud machine in France. Gas turbines have never been used except in these two countries. Late in 1940, however, experiments were made by an engineering company in Massachusetts preparatory to introduction in the United States of a new type of gas turbine.

Consult *Power* (vol. xxxv., No. 6, pp. 191–5).

Gata, SIERRA DE. See GUADARRAMAS.

Gatacre, SIR WILLIAM FORBES (1843–1906), English general, first served in the Hazara or Black Mountain expedition on the northwest frontier of India, in 1888. He then went through the Burmese campaign of 1889–90. He left India in 1897, and proceeded to the Sudan, where he took command of the British brigade which did such excellent service at the Battles of Atbara and Omdurman. On the outbreak of the South African War he was given the command of the Third Infantry Division (October, 1899). He failed to render assistance to troops at Reddersburg, who were captured by the Boers (April 4, 1900), and was recalled. After his return home he received command of the Eastern District. Consult Beatrice Gatacre's *Life* (1910).

Gataker, THOMAS (1574–1654), English divine, was born in London. In succession preacher at Lincoln's Inn, rector of Rotherhithe, and member of the Assembly of Divines at Westminster, he opposed the imposition of the Covenant, and was one of the forty-seven London clergymen who condemned the trial of Charles I. His works include: *Of the Nature and Use of Lots* (1616); *Cinnus, sive Adversaria Miscellanea* (1651).

Gatchina, or GATSCHINA, town, Russia; 28 miles southwest of St. Petersburg. It has manufactures of porcelain, and several barracks, but is especially worthy of mention for its royal palace. Pop. 15,500.

Gate, a portal or entrance into a walled enclosure, or into a structure of notable purpose or use, as the gate of a city, the gate of a fortress.

In historic times the city gates were centres of civil and social life. Through them at morning and evening passed the laborers who worked in the fields; and to them came the caravans of traders to make their markets, being forbidden entrance within the walls. Thus established as a public place, the city gate became also the seat of the popular court of justice—a custom which still survives, especially in Mohammedan countries.

Being the most vulnerable point in the walls, the gateway naturally became the place of attack by enemies, and of defence by those within; and thus the necessities of war had great influence upon its construction. Large entrances for conveyances were flanked by narrow alleyways for foot passengers.

In mediæval military architecture the gate was a ponderous barrier swung on massive hinges within an arched 'gateway' of considerable depth. A body of men attempting to batter down the gate found themselves exposed to a rain of missiles from the perforated ceiling, and from the flanking towers which commanded the gate. And if the outer barrier of solid oak were hewn in pieces, the assailants found themselves before a portcullis or grating, which dropped from the roof and formed a second barrier, through the interstices in which missiles were launched and weapons thrust at the foe.

After the invention of gunpowder, the lattice or grating became the outer defence, and the inner one was the armored gate, with loopholes through which the defenders delivered their fire. As the art of fortification developed, the gate was protected by advanced earthworks, and eventually the prominence of the gateway was lost in the outlying fortresses.

In modern times, the gateway frequently affords an opportunity for architectural design and decoration which suggest its former function of defence in the employment of massive masonry, turretted towers, and battlemented walls.

Gates, FREDERICK TAYLOR (1853–1929), American financier, was born in Maine, N. Y. He was graduated from Rochester University (1877) and Rochester Theological Seminary (1880). He was ordained into the Baptist ministry in 1880, and from 1880 to 1888 was pastor of the Central Church, Minneapolis. Subsequently (1888–93) he was corresponding secretary of the American Baptist Educational Society; and from 1893 had been representative of John D. Rockefeller in connection with several industrial, educational, and charitable organizations. He was chairman of the General Education Board.

Gates, HORATIO (1728–1806), American soldier, was born in Maldon, Essex, England. He early entered the British army, and in 1755 was sent to America, to serve against the French in the French and Indian War. As captain, he accompanied Braddock's expedition against Fort Duquesne, and was wounded in the Battle of the Monongahela. In 1762 he served as aide under Monckton in the attack on Martinique. On the peace of 1763 he purchased an estate in Virginia, where he resided until the War of Independence. In this struggle he sided with his adopted country, and in 1775 was made adjutant-general, with the rank of brigadier; receiving in 1776 command of the army which had just retreated from Canada. For a short time he served under Washington in New Jersey; and in August, 1777, superseded Schuyler in command of the Northern Department. His campaign against Burgoyne ended, after the Battles of Stillwater and Saratoga, in the surrender of the British general and his army at Saratoga (q.v.).

The success of these operations greatly enhanced the reputation of Gates, although the credit largely belonged to his subordi-

nates. He became jealous of Washington, and was probably cognizant of the Conway Cabal (see CONWAY, THOMAS), whose object was to bring about Washington's retirement and the appointment of Gates to the chief command of the Continental army; in Nov., 1777, he was made president of the Board of War (q.v.), and it was through the revelation by Gates's aide, Wilkinson, of the contents of a letter from Conway to Gates that the machinations of Conway first became known to Washington. In June, 1780, Gates was placed in command of the Southern Department, but in this position his incapacity soon became apparent, and, after being defeated by Cornwallis at Camden (Aug. 16, 1780), he was superseded (Dec. 3) by Gen. Greene. After the war he lived first in Va. and subsequently (after 1790) near New York city.

Gates, LEWIS EDWARDS (1860–1924), American author, born at Warsaw, N. Y. He was the son of the member of Congress and Abolitionist, Seth M. Gates. After taking his degree at Harvard in 1884, he studied in Europe until 1890, when he returned to Harvard University as instructor in English. His critical essays upon Cardinal Newman, Francis Jeffrey, and Matthew Arnold, with selections from their writings, are popular as text-books. *Three Studies in Literature* appeared in 1899, and *Studies and Appreciations* in 1900.

Gates, MERRILL EDWARDS (1848–1922), American educator and authority on Indian affairs, was born at Warsaw, N. Y., the son of Seth M. Gates, and graduated at the University of Rochester in 1870. After twelve years as principal of the Albany (N. Y.) Boys' Academy, he went to Rutgers College as president in 1882. From 1890 to 1899 he was president of Amherst College. For ten years from 1889 he was chairman of the U. S. Board of Indian Commissioners, and for eight years president of the Lake Mohonk Indian Conference.

Gates, SETH MERRILL (1800–77), American public man, born in Herkimer co., N. Y., and in 1827 began the practice of law at Le Roy, N. Y. On his election to the state legislature in 1832, he procured a charter for the first railroad in western New York, which subsequently became a part of the N. Y. Central R. R. system. In 1838 he became editor and proprietor of the Le Roy *Gazette*. He was a member of Congress (1839–43), and author of the famous protest by the Whigs in that body against the annexation of Texas, in 1843. His opposition to slavery provoked a Georgia planter to offer $500 for him, 'dead or alive.'

Gates, SIR THOMAS (?–*c.* 1621), first colonial governor of Virginia, was born in Devonshire, England. He was with Sir Francis Drake on his voyage to America in 1585–6, and subsequently took service for the Netherlands. He was one of the procurers of the colonizing charter of Virginia (1606). In 1609 he was chosen deputy governor, and that year sailed for Virginia with Sir George Somers and Captain Newport and 500 colonists in nine vessels. His vessel, the *Sea Venture*, having been wrecked on the Bermudas—which adventure is said to have suggested to Shakespeare his material for *The Tempest*—two new vessels were constructed. This detained him nine months, so that on arriving at Jamestown he found the colonists on the verge of starvation, indolent, and lawless. They insisted on returning to England, and so, after his installation as deputy-governor, he acceded to their request. He prevented their burning the settlement, so that, on meeting Lord De La Warr near the mouth of James River with supplies and colonists, they all returned. De La Warr having been inaugurated governor, Gates visited England for cattle and recruits. After much discouragement he returned in 1611 with a hundred cattle, three hundred colonists, and plenty of provisions. As lieutenant-governor of the colony, his aim was to make religion the basis of law and order. In 1614 he returned to England again, occupying himself there with colonizing affairs, and in 1620 he was appointed one of the council for the government of New England.

Gateshead, parl., munic., and co. bor. and seapt. in Durham, England, on the S. side of the Tyne, opposite Newcastle. The church of St. Mary is a handsome cruciform structure assigned to the 12th century, but it has been almost entirely rebuilt, the earlier edifice having been burned in 1854. The adjoining ground is called the 'Anchorage' or 'Anchoritage.' Trinity Chapel, formerly St. Edmund's, is believed to occupy the site of an ancient monastery. Among the public buildings are the town hall, public library, and hospitals. There is also a public park (Saltwell, 52 ac.). The hydraulic swing bridge, opened in 1876, occupies the site of a Roman bridge. The manufacture of locomotives, anchors, chain cables, etc., is largely carried on. The North-eastern Railway Company has a locomotive depôt and other workshops, employing about 2,000 persons; and there are large chemical and glass works. Excellent grindstone is quarried, and coal is mined. Area, 3,132 ac. Pop. (1937 est.) 117,600.

Gatesville, city, Tex., co. seat of Coryell co., 80 m. N. of Austin, on the Leon R. and on the St. Louis and S. W. R. R. It has manufactures of cotton-seed oil and flour, and is the centre of a shipping trade in cotton, grain, and cattle. The state House of Correction and the Reformatory are situated here. Pop. 1,929.

Gath, one of the five royal cities of the Philistines, on the border of Judah; was the birthplace of Goliath (1 Sam. 17:4). Fortified in 1144, it was taken by Saladin forty-seven years later, and recaptured by Richard I. of England in the next year.

Gatineau, riv., Quebec, Canada. It rises in a group of lakes N. of lat. 48°, and flows in a S. direction, through a course estimated at 400 m., to its junction with the Ottawa R. at the city of Ottawa.

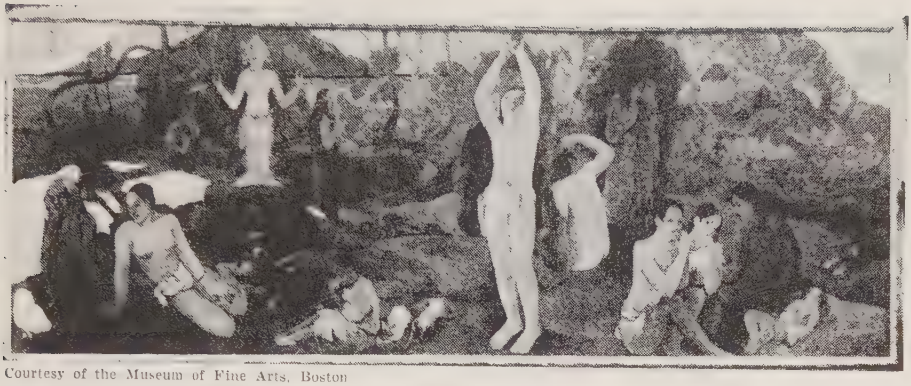
Gatling, RICHARD JORDAN (1818–1903), American inventor of the machine gun known by his name, born in Hertford co., N. C. He invented several machines for sowing seeds, and also a steam-plough, before turning his attention to firearms. His gun was patented in 1861, was used in the American Civil War, and was greatly improved in 1865 and in subsequent years. See GUNS.

Gatschet, ALBERT SAMUEL (1832–1907), Amer. ethnologist and linguist, b. near Berne, Switzerland. He studied at Berne and Berlin, devoting special attention to Swiss dialects. In 1868 he settled in New York, and, while connected with several German publications, took up the study of the dialects of the American Indians, particularly of the Tonkawa, Yuma, Creek, and Timucua tribes. In 1877 he was appointed ethnologist of the U. S. Geological Survey, and two years later the linguist of the Bureau of American Ethnology. He published numerous volumes in German and English, dealing chiefly with Indian dialects and customs, among the most important of which are *Analytical Report upon Indian Dialects Spoken in Southern California, Nevada, and on the Lower Colorado River* (1876); *Volk und Sprache der Timucua* (1881); *Indian Languages of the Pacific States and Territories of the Pueblos of New Mexico* (1882); *The Klamath Indians of Southwestern Oregon* (1890). For a full list of his contributions to Indian philology, consult Pilling's *Bibliography of North American Languages* (Washington, 1885).

Gatschina. See GATCHINA.

Gau. See GA.

Gauchos, the Hispano-Amer-



Courtesy of the Museum of Fine Arts, Boston

'D'OU VENONS-NOUS? QUE SOMMES-NOUS? OU ALLONS-NOUS?' BY PAUL GAUGUIN

Courtesy of the Chicago Art Institute

NAVE NAVE MAHANA, BY PAUL GAUGUIN

ican inhabitants of the pampas of Argentina. They have but a slight strain of Indian blood. They are the 'centaurs' of the pampas, often sleeping for hours in the saddle, while their mounts make instinctively for the nearest watering-places. Their skill in the use of the lasso is extraordinary, and has been acquired in tending the half-wild herds. Their politeness and hospitality are proverbial. But observers looking below the surface speak of their sordid nature, cruel treatment of their women, reckless gambling, licentious lives, and fanaticism without a spark of true religion. See Darwin's *Voyage of the 'Beagle,'* and Keane's *Man, Past and Present*.

Gaugamela, vil. of Assyria, a few miles east of Nineveh (and the modern Mosul), near which, in 331 B.C., Alexander the Great routed the Persian host under Darius. The battle is often known as that of Arbela, a place 40 m. farther to the east.

Gauge, the width of a railway track, measured from inside to inside of the heads of the rails. Round sharp curves this dimension is increased to the extent of half an inch at most. The gauge of railways has varied from 7 ft. (formerly the gauge of the Great Western Railway in England) to a little less than 2 ft. The standard gauge of any country is that adopted by the majority of its railways. The standard gauges of the principal countries of the world are: 3′3⅜″ (1 metre), Brazil, Sudan and Uganda; 3′6″, Queensland, Tasmania, the South African colonies and Japan; 4′8½″, Great Britain, and most of continental Europe, Canada, the United States, N. S. Wales, Egypt, Uruguay, and Peru; 5′0″, Russia; 5′3″, Ireland, Victoria, S. Australia, and New Zealand; 5′6″, India, Spain, Portugal, the Argentine Republic, and Chile. The gauge of street railways is usually 4′8½″.

Gauge, STEAM, WATER, etc. See STEAM-GAUGE, etc.

Gauguin, PAUL (1848–1903), French painter and leader of the Post-Impressionist movement, was born in Paris. His father was a journalist from Orleans; his mother was a Peruvian. He did his military service in the marines, and in 1871 he took up work in a Paris banking firm. He did not discover his talent for painting until 1875, in which year, upon the advice and encouragement of Pissaro, he spent in painting what spare time the banking business permitted him. In 1881 he decided to resign his banking position and devote his entire time to his art. He left his wife and children, traveled much on little money. For a year (1887–88) he worked on the island of Martinique and then went on to Pont Aven where he became the leader of a small group of painters. Gauguin did not articulate his theories of painting. He left that to others. Emile Bernard, Filiger, and Sérusier, using Gauguin's work as a point of departure, reduced the group's technique to a theory which gave more importance to emphasis in composition than to unity and coherence. Essential colors were painted with as great intensity as possible. The central thesis was that a painting was a plane on which a significant pattern of color was to be represented. 'Why not,' the group said, 'stress even to the point of deformation the curve of a beautiful shoulder, exaggerate the pearly whiteness of a carnation, stiffen the symmetry of boughs unmoving in the breathless air.' Gauguin's ideas and those of his group were taken up by a number of resourceful and energetic young men in Paris. Prominent among them were Bonnard Denis, Ibels, Ranson, Vuillard, and Maillol. Gauguin went in 1888 to Arles to be with his old friend Van Gogh. It had been their purpose to work together; but Van Gogh was at this time the victim of severe mental disease. Gauguin did not remain. *Le Christe Jaune* and *La Lutte de l'Ange avec Jacob* represent the best work by Gauguin in this period. In 1891, attracted by the primitive lure of the tropics, Gauguin sold all his paintings and went to Tahiti. He returned to Paris only once, was repelled by the so-called civilization of Paris. He went back to Tahiti in 1895 and remained there until his death. There he did his greatest work. The luminous, almost raw, color of the paintings in the Tahiti period characterize Gauguin's most significant undertakings. *L'esprit Veille, Seule, Jours Délicieux, La Fuite,* and *Devant la Case* are the most remarkable. In Tahiti Gauguin led the life of a native and was accepted as one of them by the Tahitians. He died on the island May 9, 1903. His last and most important painting was entitled, *D'où venons-nous? Que sommes- nous? où allons-nous?* (Whence do we come? What are we? Where do we go?) In this great allegorical painting Gauguin attempted to represent in color and line and balanced masses the unanswered questions of humankind. Moreover, it represented the impulse and the dream of Gauguin's artistic life.

Although Gauguin's work is so highly individualized as to render imitation impossible, his theories of color, mass balance, and line had great influence on his contemporaries. It can be said that his work very significantly changed the direction of modern painting.

Gaul. See FRANCE.

Gauntlet, the protective armor of the hand, dates from the 12th century. The first gauntlets—leather-covered gloves, with an unarticulated metal back—were evolved from the chain-mail bag which in the 12th century, terminated the sleeves of the hauberk. The gauntlet of the 14th century, with separate but unjointed fingers, was superseded by the 15th-century 'mitten' of jointed plates of steel, not separated for the fingers.

Gauntlett, HENRY JOHN (1805–76), English musical composer, born at Wellington, Shropshire; was organist in various London churches and from 1846 until his death held a leading place among English musical critics. The *Encyclopedia of the Chant*, though not published until 1885, was in great part the work of Gauntlett. He is best known for his hymn tunes and chants, and for his improvement of English organs.

Gaur, (*Bos gaurus*), a wild ox erroneously called by sportsmen 'Indian bison,' distributed throughout the forest regions of India and Burma, which has never been domesticated, except to a very limited extent by certain hill tribes. The color is dark, almost black, and there is a high convex ridge on the forehead between the horns. A full-grown bull may stand six feet at the withers, but owing to the slope of the back, the loins are much lower. There is no dewlap, and the ears are large. The gaur is found in large herds, and is exceedingly shy and likely to be extremely fierce and dangerous when brought to bay or wounded—a fact especially true of the Malayan variety called 'sladang.' See Baker, *Wild Beasts* (1897), and Ingersoll, *Life of Mammals* (1906). Compare GAYAL.

Gauss, KARL FRIEDRICH (1777–1855), German mathematician, born at Brunswick; won an early reputation by his *Disquisitiones Arithmeticæ* (1801). From 1807 until his death he held the directorship of the Göttingen observatory, and in 1809 his astronomical studies resulted in the valuable *Theoria Motus Corporum Cœlestium*. In 1833 Gauss erected, in conjunction with Weber, a magnetic observatory at Göttingen, and a Magnetic Association was set on foot. They published a series of volumes (1836–9) entitled *Resultate aus den Beobachtungen des Magnetischen Vereins*, those for 1838–9 containing valuable memoirs by Gauss. He conducted the trigonometrical survey of the kingdom of Hanover, and published two memoirs, *Ueber Gegenstände der höhern Geodasie* (1843 and 1846). Studies in

applied mathematics in relation to light appeared in his *Dioptrische Untersuchungen* (1840). His collected works, edited by E. J. Schering, appeared at Göttingen (1863-74; 2d ed. 8 vols. 1870-1900). See also *Lives*, in German, by Waltershausen (1856), Hänselmann (1878), and Schering (1887).

Gaussen, François Samuel Robert Louis (1790-1863), Swiss theological writer, born at Geneva. After his association with Merle d'Aubigné in the establishment of the Société Evangélique, which included among its aims the teaching of the old Calvinistic theology, Gaussen was removed from his charge at Satigny, near Geneva, in 1832 by the state council. In 1836 he became a lecturer in the new theological school at Geneva. His *La Théopneustie, ou Pleine Inspiration des Saintes Ecritures* (1840; new Eng. trans. 1888) gained considerable popularity, and his *Le Canon des Saintes Ecritures au Double Point de Vue de la Science et de la Foi* (1860; Eng. trans. 1862) is still reckoned a standard work by the older school of Biblical scholars.

Gauss's Theorem See Electrostatics.

Gautama, See Buddha.

Gautier, Théophile (1811–72), poet, and one of the most influential French prose writers of the middle of the 19th century, was born at Tarbes. As a man of letters he had a fine sense of rhythm, together with a fervent and romantic fancy. Gautier threw himself eagerly into the war of the romanticists against the classicists, and was conspicuous on the nights of the celebrated 'battle of Hernani' in 1830. (See Hugo, Victor.) Gautier made his début with a volume of verse in this same year (1830). Three years later followed another volume, *Albertus*, which is bolder and more original, although it never rises to the height of fine poetry. His prose work, *Mademoiselle de Maupin*, published in 1835, caused no small scandal at the time, because of its appeal to the lubricity of its readers. But it has immense charm of style, and in passages rises to an eloquence greatly resembling the prose of De Quincey. Balzac greatly admired *Mademoiselle de Maupin*, and engaged its author on a journal (*Le Chronique de Paris*) which he was editing. In 1838 Gautier wrote his *Comédie de la Mort*, which marks a break with his first romantic epoch. Soon after this he began his series of travel-pictures, which extend from 1845 to 1866, and describe various parts of France, Italy, Spain, Russia, and Turkey (Constantinople). During the same period Gautier was writing a series of archæological works, of which *Le Roman de la Momie* is the best known. His *Une Larme du Diable* (1839) has a certain resemblance in spirit to *Albertus*. *Le Capitaine Fracasse* (1863) is a sort of aftermath of the romantic spirit, tending more toward irony and towards the fantastic than the earlier books. In the judgment of many this is the best of Gautier's prose works. It may owe some of its inspiration to Goethe's *Wilhelm Meister*. Gautier died at Neuilly, near Paris. The following is a partial list of his principal productions: Poems—*La Comédie de la Mort* (1838); *Les Intérieurs et les Paysages* (1845); *Emaux et Camées* (1852). Novels, stories, etc.—*Une nuit de Cléopatre* (1836); *Le Roi Candaules* (1847); *Militona* (1848); *Les Roués Innocents* (1849); *Jean et Jeannette* (1850); *Partie Carrée* (1851); *Arria Marcella* (1852); *Jettatura* (1857); *Avatar* (1857); *La Belle Jenny* (1864); *Le Peau de Tigre* (1852); *Spirite* (1865); *Les Jeunes France* (1867). To these must be added the half-autobiographical *Paradis des Chats* (embodying Gautier's special affection for cats) and *Ménagerie Intime* (1869). Finally, an immense quantity of criticism of literature and art, and of the history of art: *L'Histoire des Peintres*, in collab. (1847); *L'Art Moderne* (1852); *Les Beaux-Arts en Europe* (1852); *Les Dieux et les Demi-Dieux de la Peinture*, in collab. (1856); *Histoire de l'Art Dramatique* (1860); *Histoire du Romantisme*, published in his collected *Œuvres; Tableaux de Siège* (1870–1). Biographical sketches—*Honoré de Balzac* (1859), etc. An English translation of *The Works of Théophile Gautier*, by Sumichrast, began to appear in 1900. See Sainte-Beuve's *Nouveaux Lundis* (1863–72); Spoelberch de Lovenjoul's *Histoire des Œuvres de T. Gautier* (1887); and books, in French, by Feydeau (1874), Bergerat (1878), Du Camp (1890; Eng. trans. 1893), and Richet (1893).

Gauze, a light transparent fabric of silk, woven with fine yarn, deriving its name from Gaza in Palestine, where it is said to have been first manufactured. It is extensively used for veils, dresses, sifting flour ('bolting-cloth'), etc.; a special kind is used for the mantles of incandescent gaslights and for the wire gauze of safety lamps.

Gavarni, Paul, *nom de guerre* of Sulpice Guillaume Chevalier (1801-66), French caricaturist, born in Paris. His clever sketches of Parisian life and manners led to his appointment as caricaturist of *Le Charivari*, and he also became widely known as a book illustrator. His style, always vigorous, became steadily more refined, while the subjects with which he dealt became more universal in type. After a visit to London (1849) he devoted himself to the representation of the life of the lower classes, whose misery had struck him very forcibly. His *Œuvres Choisies* appeared at Paris (1845-8), and *Perles et Parures* (1850). Among other works, Gavarni illustrated those of Balzac, and the *Wandering Jew* of Eugène Sue. See *Life*, in French, by E. and J. de Goncourt (1879), study by Duplessis (1876), and Curtis's *Masters of Lithography* (1897).

Gavazzi, Alessandro (1809–89), Italian preacher, reformer, and patriot, born at Bologna, and became a Barnabite monk. After filling the professorship of rhetoric at Naples, he became a powerful influence for Liberalism among the people of Rome, and finally abjured Roman Catholicism. He played a patriotic part during the siege of Rome (1849); and on its fall he travelled in England, the U. S., and Canada, advocating the cause of the Italian Protestants. In 1860 he accompanied Garibaldi to Sicily. Gavazzi revisited the U. S. in 1873 and 1881. His lectures in New York, with *Life* by Campanella and Nicolini, corrected by himself, appeared in 1853.

Gavelkind. In England, an ancient form of tenure of land, which obtained long before the Norman Conquest to a large extent over the entire country, and which was permitted to survive by the Norman kings in Kent and in a portion of the county of Northumberland and in Wales. Under it, the lands descend in cases of intestacy to all the sons equally; the estate did not escheat in cases of attainder for felony, and the tenant could convey it by feoffment at the early age of fifteen. This tenure has been abolished as to most of the land formerly so held, but it still prevails in a few places in Kent. See Feudal System; Tenure.

Gaveston, Piers, Earl of Cornwall (d. 1312), the favorite of Edward II., son of a Gascon knight. He was brought up as the foster-brother and playmate of Prince Edward, and early attained complete ascendency over him. For his insolence and pride he was three times banished (1307, 1308, 1312). But his last return provoked a rising of the barons, during the course of which Gaveston was taken prisoner and executed. See Marlowe's *Edward II.* (*c.* 1590).

Gavial, or Gharial, one of the crocodilians, differing from the common crocodile in the slender and elongated snout. The only

species, *Gaviatis gangeticus*, inhabits the great Indian rivers, and is quite harmless, feeding on fish. It reaches a length of twenty feet or more. An allied form is *Tomistoma Schlegeli* from Borneo, Malacca, and Sumatra.

Gavotte, a dance somewhat resembling the minuet, which flourished most in the 17th and 18th centuries. The music for it consists of an air in which there are two strains, each of four or eight bars, in $\frac{2}{4}$ or $\frac{4}{4}$ time, each strain being played twice over.

Gawain (Welsh *Gwalchmai*), hero of the Arthurian cycle, was the son of Arthur's sister and Lot, afterward king of Norway and the Orkneys. He performed gallant deeds in the war with Rome, and died in battle against his brother Mordred. But Wace says that no one knew who slew him, or where he was buried. In the hands of the French romancers Gawain became the model of all knightly virtues, and as such he is the hero of the majority of the shorter 'episodic' romances. In the Welsh *Triads* he is one of the three golden-tongued chieftains of Britain, and one of the three most courteous to strangers. This character he maintains in English mediæval romance. Up to the time of Malory the Arthur cycle in England was really the Gawain cycle. The fine poem *Syr Gawayne and the Grene Knyghte*, and the quaint story of the *Weddynge of Syr Gawayne*, both find their earliest and best parallel in Irish tradition; while another story, only preserved in the German poem of *Diu Crône*, connects Gawain with the 'Isle of Women,' a recognized part of the old Irish paradise. He is frequently termed 'the Maidens' Knight,' no satisfactory explanation of the title being given. The most famous series of adventures connected with Sir Gawain, in French romance, are those related in Chrétien de Troyes's *Perceval*, of which poem he shares the honors equally with the titular hero. In the later stages of Arthurian romance the character of Sir Gawain underwent a change for the worse; in the prose *Tristan* and the *Queste* he is painted in the blackest colors. See *Sir Gawayne*, ed. by Sir Fred. Madden for the Bannatyne Club, 1839; *Histoire Littéraire de la France*, vol. xxx. by M. Gaston Paris; *The Legend of Sir Gawain*, by J. L. Weston, Grimm Library, vol. vii. (1897); *Syr Gawayne and the Grene Knyghte*, ed. Morris, for Early English Text Society, ed. I. Gollancz (1898)—modern prose rendering by J. L. Weston.

Gawilgarh, fortress, Berar, British India, 15 m. w. of Ellichpur; was taken by Wellesley in 1803.

Gay, Edward (1837), American artist, was born in Dublin, Ireland, and was brought to America in 1848. He studied art under James Hart at Albany, N. Y., and under Lessing at Düsseldorf, and established himself in New York city in 1867. In 1870 he was made a member of the National Academy. His specialty was landscape, both in oil and water color. His painting, *Broad Acres*, received the Metropolitan prize of $2,000 in 1887, and is placed in the Metropolitan Museum in New York.

Gay, John (1685–1732), English poet, was born at Barnstaple in Devonshire. Going up to London, he published his first poem, *Wine*, in 1708. In 1712 he obtained the post of secretary to the Duchess of Monmouth. In the following year he published *Rural Sports*, which he inscribed to Pope; and *The Wife of Bath*, a comedy, which was acted at Drury Lane. In 1714 he produced *The Fan*, a poem; and *The Shepherd's Week*, a series of six pastorals, written to ridicule the pastorals of Ambrose Philips. These pieces established Gay's literary reputation. In the year 1714 he became secretary to the Earl of Clarendon, ambassador to Hanover. He next wrote *What d'ye Call it?* a farce, which appeared at Drury Lane (1715); *Trivia, or the Art of Walking the Streets of London* (1716), a sprightly mock-heroic poem, and a veritable mine of information on the out-door life of the period; and *Three Hours after Marriage* (1717), a comedy in which he is said to have had the assistance of Pope and Arbuthnot, but which was none the less a mortifying failure. In 1720 he published his poems, and realized £1,000, but speculated and lost it all. In 1724 he produced a tragedy, *The Captives*, and in 1727 his *Fifty-one Fables in Verse*. But his crowning achievement was the *Beggar's Opera* (1728), which for a season drove the Italian opera out of England. A sequel, called *Polly*, was refused a license by the lord chamberlain, but was published in 1729. The Duke and Duchess of Queensberry now took Gay into their house, and with them he spent the remainder of his days. He was buried in Westminster Abbey. Perhaps he is best known now by his *Fables* and such ballads as *Black-eyed Susan* and *'Twas when the Seas were Roaring*. Collected works are *Plays* (1760); *Works* (4 vol. 1770); *Gay's Chair: Poems never before printed* (1820); *Fables*, ed. by Austin Dobson (1882); *Poems*, ed. by J. Underhill (2 vols. 1893). See Coxe's *Life* (2d ed. 1797) and Johnson's *Lives*.

Gay, Sydney Howard (1814–88), American journalist and historian. He was born in Hingham, Mass., and studied for a time at Harvard. He prepared for the law, but was denied admission to the bar, owing to Abolitionist principles, which deterred him from taking the oath to support the Constitution. In 1842 he became a lecturer for the National Anti-Slavery Society, and in 1844 the editor of the *Anti-Slavery Standard*. From 1862 to 1866 he was managing editor of the New York *Tribune*, to which he had contributed for many years. He joined the staff of the Chicago *Tribune* in 1868, and in 1872 became an editorial writer upon the N. Y. *Evening Post*. The *Popular History of the United States*, by William Cullen Bryant and Sydney Howard Gay, owed its accuracy and graphic qualities chiefly to him, Mr. Bryant contributing but little more than his name. For the 'American Statesmen Series' he wrote a *Life of Madison* (1884).

Gay, W. (1856–1937), American painter, born in Hingham, Mass. He began by painting flowers, but in 1876 went to Paris, where he entered Bonnat's studio, and in 1879 won recognition at the Salon with his *Fencing Lesson*. His *Bénédicité* was bought by the French Government and given to the Amiens museum, and *Las Cigarreras* is in the Paris Luxembourg gallery. His *Spinners*, which won honorable mention at the Salon of 1885, is in the N. Y. Metropolitan Museum. The Tate Collection in London and the Boston Museum of Fine Arts also have some of his important pictures. He devoted much work to portraying the interiors of the more important French châteaux. He died in Paris.

Gaya, chief tn., Gaya dist., Bengal, India, 57 m. s. of Patna by rail. Six miles to the s. is Buddha Gaya, the site of a temple dating from B.C. 543, and of a bo-tree sprung from that under which Buddha attained Nirvana. Gaya is annually visited by many pilgrims. Pop. (1931) 88,005.

Gayal (*Bos frontalis*), or Mithan, a semi-domesticated, also wild, ox in the hilly districts of N.E. India. It is smaller than the gaur, has a straight forehead without the frontal crest, smaller and straighter horns, a dewlap in the male, while the back has also a less-marked slope than in the gaur. Apparently the gaur and the gayal interbreed, but the latter is of a much milder disposition. See Gaur.

Gayangos y Arce, Pascual de (1809-87), Spanish scholar and bibliophilist, born at Seville; studied in France under De Sacy, and spent many years in

England. He was professor of Arabic at Madrid University from 1843 to 1881. He wrote *Historia de los Reyes de Granada* (1842); translated into Spanish, with additions, Ticknor's *History of Spanish Literature* (1851), and edited '*Gran Conquista de Ultramar*' (1849), '*Libros de Caballería*' (1849), and a collection of '*Escritores en Prosa, anteriores al Siglo XV.*' (1849). He also issued the English translation of Al-Makkari's *History of the Mohammedan Dynasties in Spain* (1840), a work of great erudition.

Gayarré, CHARLES ETIENNE ARTHUR (1805–95), American historian and legislator, was born in New Orleans, La. In 1829 he was admitted to the Philadelphia bar. He was a member of the Louisiana legislature (1830 and 1844–6); was elected to the U. S. Senate (1835), but was prevented by ill health from serving; and was secretary of State of Louisiana (1847–53). He wrote: *Histoire de la Louisiane* (1847); *Romance of the History of Louisiana* (1848; 4 vols., 1866); *Louisiana* (1848–52); *Philip II. of Spain* (1866).

Gay Head, town, Dukes county, Massachusetts, at the west end of Martha's Vineyard. A lighthouse is situated on the cliffs nearby. There is an Indian reservation here. Pop. 200.

Gayley, C. M. (1858–1932), American educator, was born in Shanghai, China. He was educated in England and Ireland, and was graduated from the University of Michigan in 1878. After a post-graduate course in Germany, he was instructor in Latin, then in English, at the University of Michigan (1880–89), and in 1889 became professor of English at the University of California. He has written or edited: *Guide to the Literature of Æsthetics* (1890); *Classical Myths in English Literature* (1893); *Methods and Materials of Literary Criticism* (with F. N. Scott, 1899); *Representative English Comedies* (1903); *Principles and Progress of English Poetry* (with C. C. Young, 1904); *Songs of California* (1905); *Plays of Our Forefathers* (1907); *Idols of Education* (1910).

Gay-Lussac, JOSEPH LOUIS (1778–1850), French chemist and physicist, was born in St. Léonard, Haute-Vienne. After acting as assistant to Berthollet, he carried on researches into the composition of the atmosphere, in conjunction with Biot. These resulted in Gay-Lussac's important discovery that the proportions by volume in which gases combine are simply related, both to each other and to the volume of the product. Other important researches were connected with the composition of water, in conjunction with A. von Humboldt (1805); the expansion of gases and of fluids, and the process of evaporation. With Thénard he discovered a process for producing potassium by chemical action. In 1813–14 he published valuable memoirs on iodine; and in 1815 he isolated the compound radicle cyanogen.

In 1809 Gay-Lussac was appointed professor of chemistry at the Ecole Polytechnique, and, in 1832, at the Jardin des Plantes, Paris. The later years of his life were chiefly devoted to the practical applications of chemistry in connection with fermentation, bleaching, the manufacture of sulphuric acid, and gunpowder. Among his numerous scientific works were *Mémoires sur l'Analyse de l'Air Atmosphérique* (with von Humboldt, 1804); *Recherches Physico-Chimiques faites sur la Pile* (with Thénard, 1811); *Cours de Physique* (1827). Some of his work appeared in the *Annales de Chimie*, of which he was joint editor with Arago for about thirty years.

Gaylussacia, a genus of American shrubs of the order Ericaceæ, and including some of the huckleberries (q. v.).

Gaynor, WILLIAM JAY (1851–1913), American jurist and public official, was born in Oneida county, New York, and was educated in Boston. While studying law in New York he worked on the newspapers of that city and of Brooklyn, and began practice in 1875. He acquired wide publicity by his opposition to 'rings' in the local Democratic Party, and especially by his success in convicting John Y. McKane for election frauds at Gravesend. Although a Democrat in national politics, he was nominated by Republicans and Independents for the State supreme court in 1893, and was elected for the term ending in 1907. He was re-elected for the term ending in 1921.

After repeatedly declining to be a candidate for mayor and for governor, Judge Gaynor was in 1909 elected mayor of New York City on the Democratic ticket, defeating Otto H. Bannard, Republican, and William R. Hearst, Independent. In 1910 an attempt was made on his life by a discontented former employee of the city, who shot him in the head while he was about to embark at Hoboken, N. J., on a trip to Europe. Though seriously wounded, he recovered, and resumed his official duties.

Economy and efficiency were the aim of his administration as mayor, which was signalized by extensive additions to the city's subway system. In August, 1913, toward the close of his administration, he was renominated for mayor as an independent candidate, but he died on shipboard on Sept. 11, 1913, while on his way to Europe.

Gaynor was well known not only as a courageous advocate of popular government, but as a student of human nature and a philosopher. He gained a wide reputation as a writer of wise and witty letters on many subjects.

Gaza (modern *Ghuzzeh*), city Palestine, near the Mediterranean; 12 miles northeast of Rafah. It is the commercial centre of the district, and exports wheat, barley, sesame, and wool to the value of about $250,000 per annum. Pop. 40,000.

Gaza was one of the five chief cities of the ancient Philistines, and was the scene of constant struggles between the Israelites and the Philistines. In 333 B.C. it was taken by Alexander the Great, and from that time to 1799, when the French under Kléber captured it, it witnessed the victories of the Maccabees, the Calif Abu-bekr, the Templars, and Saladin.

Gazaland, territory in Portuguese East Africa, watered by the Sabi and Limpopo. The higher parts present sandy, waterless tracts matted with thorny scrub. The inhabitants are Bantus.

Gazelle (*Gazella*), a genus of small antelopes, including some of the most beautiful of these animals, characterized by their lyrate horns. The majority inhabit the sandy deserts of North

Dorcas Gazelle.

Africa, and all are of a yellowish color, with characteristic face marking. This consists of a dark triangle on the forehead, defined by two white streaks, which extend from the base of the horns to the nose, and are bordered externally by dark stripes.

The horns are usually present in both sexes, are oval in section, and ringed throughout. Examples are the Dorcas gazelle (*G. dorcas*), which is barely twenty-four inches high at the shoulder; the Indian gazelle (*G. Bennetti*), occurring outside the African area; the Arabian gazelle (*G. Aarabica*); and the mountain gazelle (*G. Cuvieri*) of Morocco and Algeria.

Gazetteer, a geographical dictionary, containing descriptions and statistics (often with historical details) of natural and political divisions—countries, cities, towns, rivers, mountains, etc.—of the world, or of any portion of it, arranged in alphabetical order. The first known book of this kind is the work of Stephen of Byzantium, in the sixth century. The first use of the word in this sense seems to have been made by Laurence Echard, who published *The Gazetteer's or Newsman's Interpreter* in 1703 and 1704. The gazetteers of the sixteenth and seventeenth centuries are full of extraordinary errors; those of the eighteenth are more accurate; but it was not until the nineteenth century that the work was pursued with scientific method. The first important gazetteers of the century were Hassel's *Geographisch-Statistisches Handwörterbuch* (1817); the *Universal Gazetteer* (1808), and the *Edinburgh Gazetteer* (1817–22). In the middle of the century the authoritative works in English were Blackie's *Imperial Gazetteer* (1850) and Johnston's *Dictionary of Geography* (1850), both of which were superseded by Longman's *Gazetteer of the World* (1895).

Lippincott's *Gazetteer*, especially comprehensive for the United States and America generally, appeared in Philadelphia in 1855; the latest edition was published in 1906. Ritter's *Geographisch-Statistisches Lexikon* (new edition, 1905–6) is foremost among the dictionaries of universal geography in the number of its entries. Another recent German gazetteer is Webersik's *Geographisch-Statistisches Welt-Lexikon* (1908). Garollo's *Dizionario Geografico Universale* (1898) is especially trustworthy. A truly monumental work is Vivien de St.-Martin's *Nouveau Dictionnaire de Géographie Universelle* (1879–95; with supplement for 1897–1900). Among special gazetteers may be enumerated those of Bartholomew, Cassel, and Mackenzie, for Great Britain; Hunter's *Imperial Gazetteer of India* (1886–8; new ed. 1910); Neumann's *Ortsund Verkehrslexikon*, for Germany; the great work of Semenoff (1863–85), for Russia; and the government series of departmental gazetteers for France. Gazetteers of the various States, and also of the Philippine Islands, are published in the United States.

Gaz-kul (also called Zor-kul, Sari-kul, Wood's Victoria Lake), on the Pamir, Central Asia, at an elevation of over 13,000 ft. Another Gaz-kul, the source of the N. branch of the Upper Oxus (the Ak-su, or White Water), lies at about 13,850 ft., near the head of the Little Pamir valley. A third lake (called also Ghaz-nor) lies at the S. foot of the Altyn or Astyn-tagh (Kuenlun system), in the N.E. of Tibet (38° N. lat. and 91° E. long.), at an alt. of about 10,000 ft.

G.C.B., (Knight) Grand Cross of the Bath.

Géant, COL DU, glacier pass (11,600 ft.) in the Alps, leading from Chamonix in France to Courmayeur in Italy. It became well known after H. B. de Saussure spent seventeen days there in 1788, making scientific observations. The Aiguille du Géant (13,170 ft.) towers above it on the N.E.

Gearing is generally understood to refer to wheel or toothed gearing and friction gearing, with their necessary adjuncts of shafting, bearings, etc. For a description of BELT AND ROPE GEARING, and of the gearing of MOTOR CARS and CYCLES, see the articles under those headings.

The relative motion or *velocity ratio* of wheels in gear is identical with that of toothless rollers driving one another by mutual friction without slip; consequently the velocity ratio under these conditions must be inversely proportional to their radii, diameters, or circumferences, because equal arcs must be passed over in equal times, and the length of these arcs must bear the same proportion to their circumferences, of which they form a part, as the latter do to each other. Thus, in Fig. 1 let N_1N_2 and D_1D_2 represent respectively the revolutions in a given time, and the diameters of the rolling cylindrical discs A and B; then, since there is assumed to be no slip at the point of contact,

$$\pi D_2N_2 = \pi D_1N_1, \text{ or } D_2N_2 = D_1N_1.$$
$$\therefore N_2 : N_1 :: D_1 : D_2.$$

The velocity ratio of any combination of gearing is always represented by the relation which the speed (N_2) of the last wheel bears to the speed (N_1) of the first wheel; thus, in the above cases the

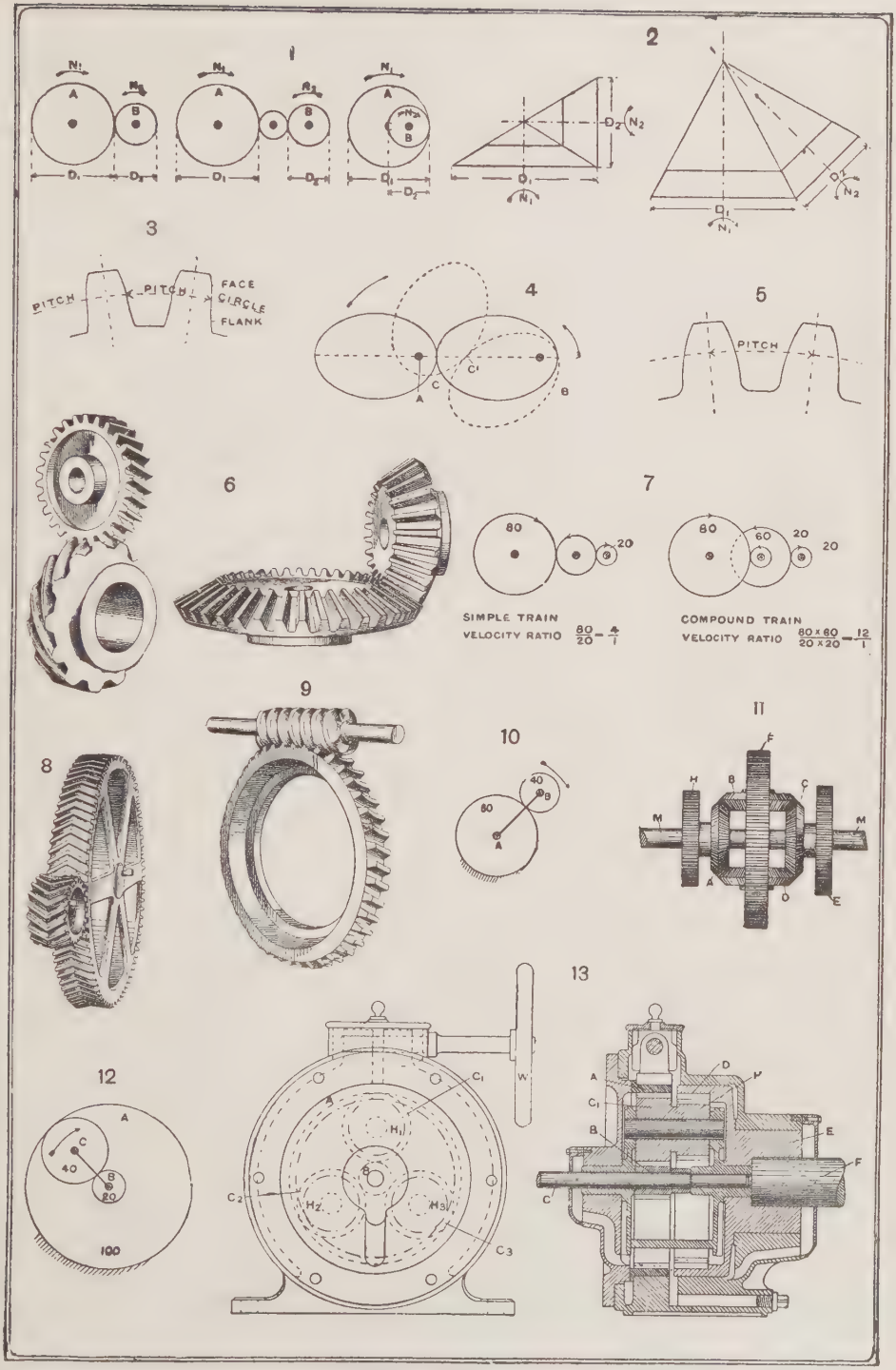
$$\textit{velocity ratio} = \frac{N_2}{N_1}$$

The *direction of motion* of the last wheel in a system of gearing will depend upon the number of wheels and their arrangement. In Fig. 1 several combinations are shown, and the arrows indicate the direction of motion in each case. When the axes of revolution are not parallel but intersect, the circular discs are replaced by rolling conical surfaces, as shown in Fig. 2. In order to transmit motion with accuracy, which would not be possible if pure frictional contact alone were relied upon, projections or teeth are formed upon the rolling surfaces, and the contour or shape of these teeth must be such that the friction between them when in gear shall be the least possible. The rolling surfaces—cylindrical or conical—are generally called *pitch* surfaces or *pitch circles;* and these pitch surfaces, which represent the motion of the wheels, must be in contact when the wheels are in gear; the teeth are spaced round the pitch surfaces at equal distances (the *pitch*) apart. (See Fig. 3.) If T, D, and P represent respectively the number of teeth, diameter of pitch circle, and pitch, then

$$TP = \pi D, \text{ or } P = \frac{\pi D}{T}. \quad (\pi = 3.1416.)$$

Spur wheels are used for transmitting motion between parallel shafts. *Bevel* wheels are used when the axes of the shafts intersect; and when the axes of the shafts are not parallel and do not intersect, the teeth are formed on the surfaces of frustra of two hyperboloids, such wheels being termed *skew bevel* wheels. In all the above cases the velocity ratio is assumed to be constant; but a variable velocity ratio may be obtained by means of wheels with non-circular pitch surfaces. Thus, if two equal ellipses (Fig. 4) be centred about their foci A and B, and placed in contact so that the distance between the centres is equal to the sum of the focal distances, although one of them may rotate with a constant speed, the other, or driven ellipse, will have a variable velocity. This is evident from the fact that the pitch surface radii AC and BC of the two wheels at the point of contact are continually varying. The curves generally adopted for the contour or profile of wheel teeth are the cycloidal and involute. In order that the velocity of two wheels in gear may be kept constant, it is necessary that the profiles of the teeth should be so formed that the common perpendicular to the outlines of any two teeth, when they are in contact, must pass through the point where the pitch circles of the two wheels touch. Provided the above condition is fulfilled, any curve may be used for the profiles of wheel teeth.

A *cycloid* is the path traced out by a point on the circumference of a circle, called the describing or rolling circle, as it rolls on a straight line. The profiles of teeth used in forming a *rack*, in which the pitch circle becomes a straight line, would be cycloids. If the describing circle rolls *out-*



GEARING—FIGS. 1–13.

(For explanation of Figs. see text.)

Gearing

side or *inside* another circle—the pitch circle—an *epicycloid* or *hypocycloid* respectively is traced out. If the diameter of the describing circle is equal to the radius of the circle in which it rolls, the hypocycloid becomes a straight line, and the teeth formed under these conditions have radial flanks — the portion below the pitch circle. The *involute* curve is formed in the following way: If a cord be unwound from a circle and always kept taut, the curve traced out by a point in the cord will be an involute of the circle. Epicycloidal curves are used for the *face* of the teeth —the portions of the teeth above the pitch circle—the *flanks* being formed with hypocycloidal curves. Involute teeth have the same curve for both face and flank. Examples of cycloidal and involute teeth are shown in Figs. 3 and 5.

The size of the rolling circle influences the strength of the teeth. Thus, a large rolling circle forms a tooth which is narrow at the base or root. Involute teeth are generally stronger than cycloidal teeth, but they cause excessive thrust on the shaft bearings. At the same time, involute teeth possess the advantage that the wheel centres may be displaced slightly nearer or further apart without disturbing the accuracy of contact; this cannot be done with cycloidal teeth. Examples of bevel and skew-bevel wheels are shown in Fig. 6.

Teeth which have been correctly designed, made, and fitted, will, after being in action for some time, show evidence of uniform contact from the point of each tooth to some distance below the pitch line. If the wheels work noisily, it will be found that the above evidence of uniform contact is wanting in some of the teeth, clearly indicating that the driving pressure is not being borne equally by all the teeth. The speed of the pitch circles in ordinary gearing is usually about 2,500 ft. per minute. Sometimes the teeth are strengthened by having a flange (called a *shroud*) cast solid, with the teeth on each side of the wheel. Sets of wheels are arranged in combinations or trains. If there is one wheel on each axis, the train is called a *simple* one; but if one or more of the axes have two wheels which rotate together, the train is *compound*. (See Fig. 7.) The numbers on the circles represent the teeth in each wheel. The greatest practical velocity ratio obtainable from a simple train is about 6 to 1. Compound trains are used when greater velocity ratios are required.

Toothed wheels are made of cast iron, cast steel, or brass. Latterly, wheels with raw-hide teeth have been largely used for high-speed gearing, especially in cases where it has been necessary to bring about a large reduction of speed — as, for example, an electric motor driving some slow-speed machine. Here a pinion (small wheel) with raw-hide teeth is mounted on the shaft of the motor, and gears with a wheel with metal teeth on the driven machine. These gears wear very well, and run with little noise.

Mortise gearing consists of wheels with a cast-iron body or frame fitted with wood teeth or cogs. Toothed wheels are generally cast from a wood pattern, but a better method is by machine-moulding. Here two or three teeth, together with a portion of the rim, are attached to the end of an arm which can be revolved about a vertical axis; the wheel is gradually moulded by moving the arm from point to point, and taking the impression of the teeth in sand. Machine-cut wheels, in which the spaces between the teeth are cut out from the solid by means of a properly-shaped revolving cutter, are no doubt the best and most accurate.

Helical gearing (Fig. 8) is a modification of ordinary toothed gearing, in which the pitch surfaces may be cylinders or cones, as in spur or bevel gearing; but the teeth intersect the pitch surfaces in helical lines. These wheels work much more smoothly and are stronger than ordinary gearing.

Screw-and-worm gearing (Fig. 9) is a type of gearing in which the velocity ratio is independent of the radii of the pitch surfaces, the teeth of the wheels being essentially portions of screw surfaces. A high velocity ratio can be obtained with comparatively small wheels, and the axes may be at any angle. This kind of gearing is used for speed-reducing gears; but unless the wheels are very accurately constructed and run in an oil-bath, the efficiency is low, because of the large amount of friction. In ordinary worm-and-wheel gearing the worm drives the wheel, the gears not being reciprocal. The wheel contains many teeth (*i.e.* portions of many screw threads), and the worm one, two, or three—seldom more — *complete* screw threads. For each revolution of a worm with one thread the wheel will be moved round through a space represented by one tooth. Thus, with a wheel with ninety teeth and a single-threaded worm, the wheel would make one revolution for every ninety revolutions of the worm.

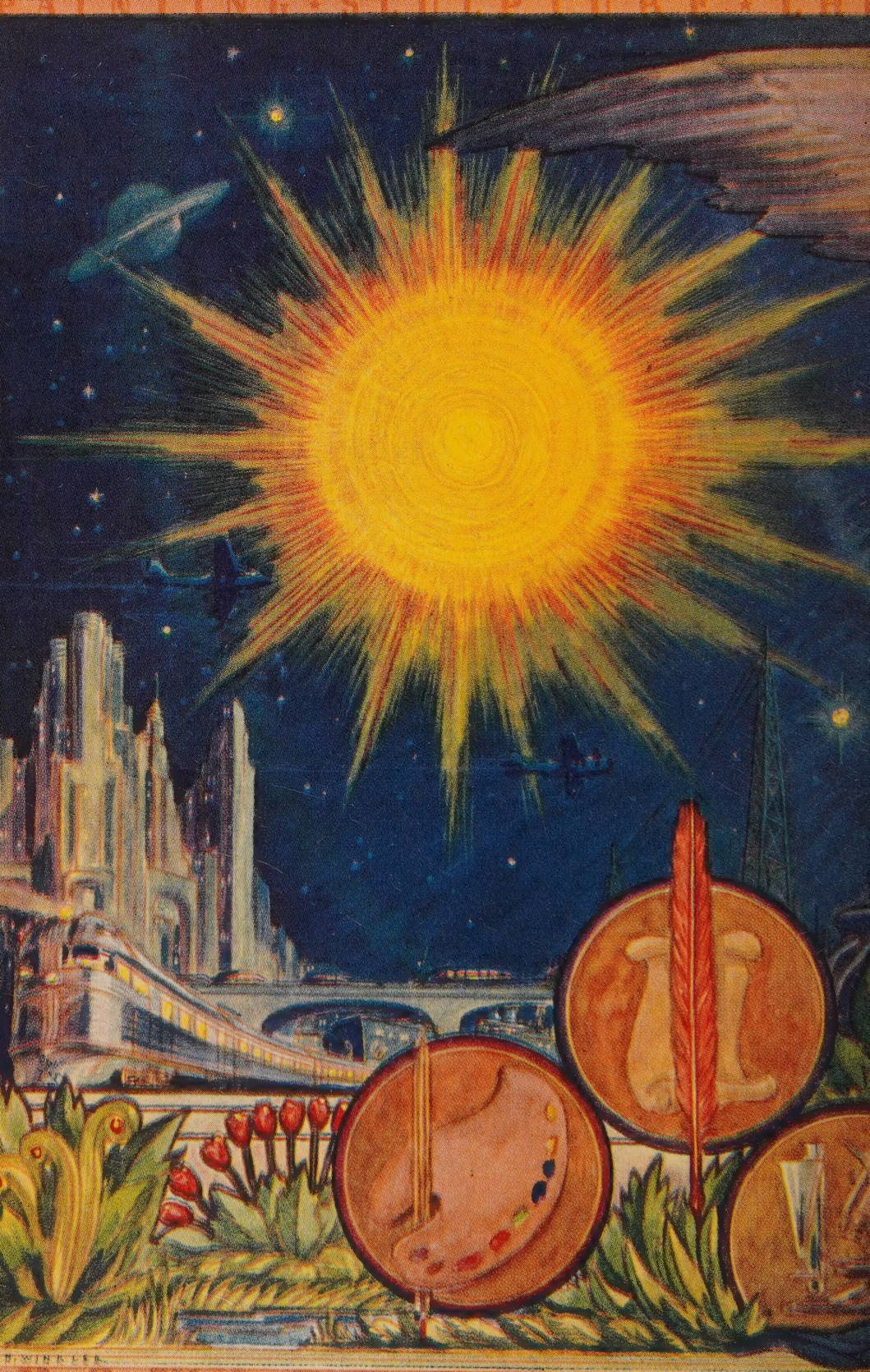
Power transmitted by Toothed Gearing.—The following rule is suggested by Messrs. Musgraves, Bolton, England, and is found to give satisfactory results:

Let P = pitch in inches, B = breadth of wheel in inches, V = velocity of pitch circle in feet per minute. Then horse-power transmitted $= \frac{P^2BV}{1000}$ for cast-iron wheels; horse-power transmitted $= \frac{P^2BV}{625}$ for cast-steel wheels.

We describe a few out of many applications of toothed wheels.

Epicyclic Trains.—In this arrangement one or more of the wheels in the train are carried round by means of a revolving arm, while they gear with a wheel which may be fixed or have an independent motion imparted to it. Points on the peripheries of the wheels attached to the revolving arm describe cycloidal curves, hence the name. In Fig. 10 a simple form of epicyclic gearing is shown. The wheel A with eighty teeth is fixed; the arm CD revolves about C as centre, and carries a wheel B with forty teeth. In this case the wheel B makes three revolutions for each revolution of the arm, and in the same direction. Watt's 'sun and planet' motion is an example of epicyclic gearing.

Houldsworth's differential gearing (Fig. 11) has a most important application in spinning machinery, where it is used to regulate the speed of the bobbins. When they are being filled with thread, the speed of revolution diminishes in such ratio as to preserve a constant tension on the thread. This gearing consists of four equal bevel wheels, A, B, C, and D, of which B and D are here shown mounted on axes, placed in the plate of a spur wheel F, and are capable of turning about their own axes while the wheel F revolves. A is keyed to a shaft M, which may be driven through a wheel H; but F and C, to which E is attached, ride loose on the shaft. A is the driver, and F receives independent motion determined by the rate at which the bobbins are being filled; E is connected with the mechanism for revolving the bobbins. If F makes three revolutions while A makes four, then C will move half as fast as A. Again, let F make one revolution for two revolutions of A; then C stops altogether. Thus, by suitably regulating the speed of F, any desired degree of revolution can be imparted to C and to the bobbins. Epicyclic gearing is also used for speed-reducing purposes. In Fig. 12, A represents a fixed annular or internally-toothed wheel with one hundred teeth; B, with twenty teeth, is attached to the high-speed shaft; and the arm carrying a wheel C with forty teeth, which gears simultaneously with



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